University of Pune

Faculty of Engineering

Board of Production and Industrial Engineering

Master of Engineering Syllabus 2013

Manufacturing and Automation Engineering

M. E. – Production Engineering [Manufacturing and Automation] 2013

Semester I

Code	Subject	Teaching Scheme	Examination Scheme					Credits
		Lecture / Practical	Paper Assessment		TW	Oral / Presentation	Total	
			In-Semester	End-Semester				
511101	Mathematics & Statistics	4	50	50	-	-	100	4
511102	Industrial Automation	4	50	50	-	-	100	4
511103	Advanced Manufacturing Processes	4	50	50	-	-	100	4
511104	Research methodology	4	50	50	-	-	100	4
511105	Elective I	5	50	50	-	-	100	5
511106	Lab Practice I	4	-	-	50	50	100	4
Total		**25**	**250**	**250**	**50**	**50**	**600**	**25**

M. E. – Production Engineering [Manufacturing and Automation] 2013

Semester II

Code	Subject	Teaching Scheme	Examination Scheme					Credits
		Lecture / Practical	Paper Assessment		TW	Oral / Presentation	Total	
			In-Semester	End-Semester				
511107	Computer Integrated Manufacturing	4	50	50	-	-	100	4
511108	Tool and Die Design	4	50	50	-	-	100	4
511109	Advanced Joining Processes	4	50	50	-	-	100	4
511110	Elective II	5	50	50	-	-	100	4
511111	Lab Practice II	4	-	-	50	50	100	5
511112	Seminar I	4	-	-	50	50	100	4
Total		**25**	**200**	**200**	**100**	**100**	**600**	**25**

M. E. – Production Engineering [Manufacturing and Automation] 2013

Semester III

Code	Subject	Teaching Scheme	Examination Scheme					Credits
		Lecture / Practical	Paper		TW	Oral / Presentation	Total	
			In-Semester	End-Semester				
611101	Advanced Robotics	4	50	50	-	-	100	4
611102	Surface Engineering	4	50	50	-	-	100	4
611103	Elective III	5	50	50	-	-	100	5
611104	Seminar II	4	-	-	50	50	100	4
611105	Project Work Stage I	4	-	-	50	50	100	8
Total		**25**	**150**	**150**	**100**	**100**	**500**	**25**

M. E. – Production Engineering [Manufacturing and Automation] 2013

Semester IV

Code	Subject	Teaching Scheme	Examination Scheme					Credits
		Lecture / Practical	Paper		TW	Oral / Presentation	Total	
			In-Semester	End-Semester				
611106	Seminar III	5	-	-	50	50	100	5
611107	Project Work Stage II	20	-		150	50	200	20
Total		**25**	**-**	**-**	**200**	**100**	**300**	**25**

Elective I

- Reliability & Failure Analysis
- Materials Technology
- Manufacturing Management
- Advanced Mechatronics

Elective II

- Advanced Machine Tool Design
- Plastics Processing
- Supply Chain Management
- Product Life Cycle Management

Elective III (Open Elective)

- Optimization Techniques
- Engineering Economics & costing
- Occupational Health and Industrial Acts
- Energy Management
- Intellectual Property Rights

511101

Mathematics and Statistics 2013

Teaching Scheme	Examination Scheme
Lectures: 4 hrs/week	In semester: 50
Credits – 4	End semester: 50

1. COMPLEX VARIABLES

Analytical functions, conformal mapping, bilinear transformations, complex integration, Cauchy's integral theorem and formula, Taylor's and Laurent's series, Cauchy's residue theorem, Applications to Dirichlet's and Neumann's problems.

2. CALCULUS OF VARIATIONS

Introduction, Variational notation, Euler's first order condition with extension to several independent variables, constraints and Lagrange's multipliers, Hamilton's principle, Lagrange's equation in generalized co-ordinates, strum-Liouville's equation with orthogonal character of the solution for different values of physical problems involving differential equations expressed as Variational problems Galerkin's and Raleigh- Ritz method.

3. NUMERICAL SOLUTION TO PARTIAL DIFFERENTIAL EQUATIONS

Difference equations and their types, Solutions of difference equations, finite difference equivalence of solutions of Elliptic Parabolic and hyperbolic equations. Applications to Laplace, Poisson and Cauchy's equations.

4. SPECIAL FUNCTIONS

Differential Equations and its solutions in series, Bessel's and Legendre's differential equations and their series solutions, properties of Bessel's functions and Legendre's polynomials, generating functions, recurrence relations, Fourier Bessel expansion of function and its applications to boundary value problems.

5. MATHEMATICAL MODELLING

Proportionality Models, fitting models to data, creating simulations, dimensional analysis, probabilistic modeling, optimization (discrete and continuous models), multivariate random number generation, bootstrapping, Monte Carlo simulation, efficiency improvement techniques, simulation output analysis.

6. STATISTICS AND PROBABILITY

Random variables, various distributions, sampling theory, Chi- square test, t-tests, elementary Stochastic process's, Markov-chain, Markov process, reliability testing. Control chart.

References

1. Erwin Kreyzig, Advanced Engineering Mathematics, Jhon Wiely & Sons. ISBN: 0470458364
2. Spiegel, Complex Variables, Schaum's Series. ISBN: 0070602301
3.B.S.Grewal, Numerical Methods in Engineering and Science, Khanna Publishers, New Delhi.
4. Mark Meerschaert, Mathematical Modeling, Elsevier. ISBN: 0123708575

5. B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers, New Delhi. ISBN: 8174091955

511102

Industrial Automation 2013

Teaching Scheme	Examination Scheme
Lectures: 4 hrs/week	In semester: 50
Credits – 4	End semester: 50

1. AUTOMATION USING HYDRAULIC SYSTEMS

Hydraulic fluid, fluid mechanics, design aspects of various elements of hydraulic systems such as pumps, valves, filters, reservoirs, accumulators, actuators, intensifiers etc. and their selection. Practical case studies on hydraulic circuit design and performance analysis. Servo valves, hydraulic servo actuators, electro hydraulic servo-valves, proportional valves and their applications, Modeling and Simulation of Electro-hydraulic Servo systems.

2. AUTOMATION USING PNEUMATIC SYSTEMS

Pneumatic fundamentals - control elements, position and pressure sensing -logic circuits - switching circuits - fringe conditions modules and these integration - sequential circuits - cascade methods - mapping methods – step counter method - compound circuit design - combination circuit design. Pneumatic equipments - selection of components – design calculations -application - fault finding – hydro pneumatic circuits –

3. CONTROL TECHNOLOGIES IN AUTOMATION

Industrial Control Systems, process industries verses discrete-manufacturing industries, continuous versus discrete Control. Computer based control process and its forms. Open and closed loop control system. Control system components. Introduction to sensor technology, various sensors, transducers, signal processing. Programming of microprocessors using 8085 instructions. Programmable logic controllers.

4. AUTOMATED WORK PIECE HANDLING

Working principles and techniques, job orienting and feeding devices. Transfer mechanisms, automated feed cut of components, performance analysis. Types of automated handling systems including AGV and its various guiding technologies, applications.

5. INTRODUCTION TO ROBOT TECHNOLOGY

Robot classification, robot elements, Robot co-ordinate systems, Position, path and speed control systems, robot programming for foundry, presswork, and machining. Collisions free motion planning.

6. MODELING AND SIMULATION FOR MANUFACTURING PLANT AUTOMATION

Introduction/ need for system Modeling, Building Mathematical Model of a manufacturing plant, Modern Tools- Use of Fuzzy decision making and Artificial Neural Networks in manufacturing automation, AI in manufacturing systems

REFERENCES

1.Mikell P. Grover “Automation, Production Systems and Computer-Integrated Manufacturing” Pearson Education, New Delhi. ISBN: 0132393212

2.Antony Esposito, “Fluid power with Applications” Pearson Education India. ISBN:8177585800

3. Andrew Parr, " Hydraulic and Pneumatics ", Butterworth-Heinemann. ISBN:0750644192

4. Bolton. W. “Pneumatic and Hydraulic Systems” Elsevier Science & Technology Books. ISBN:0750638362

5. N. Viswanandham, Y. Narhari “Performance Modeling of Automated Manufacturing Systems” Prentice-Hall. ISBN: 0136588247

6. S. R. Mujumdar, “Pneumatic system”, Tata McGraw Hill. ISBN: 0074602314

7. W Bolton., “Mechatronics: Electronic Control Systems in Mechanical and Electrical Engineering” Prentice-Hall. ISBN: 0131216333

8. C D Johnson, “Process Control Instrumentation Technology”, Prentice Hall of India, New Delhi. ISBN: 8120309871.

511103

Advanced Manufacturing Processes 2013

Teaching Scheme	Examination Scheme
Lectures: 4 hrs/week	In semester: 50
Credits – 4	End semester: 50

1. PRINCIPLES OF CASTING

Principles of Casting – metals and their alloys, Mechanism of melting and solidification, grain growth and structure, shrinkage defects. Mold filling – fluidity and turbulence, filling under gravity and pressure; filling defects; gating design, Injection Molding, Simulation of Mold filling and Solidification.

2. FUNDAMENTALS OF FUSION WELDING

Fundamentals of fusion welding processes – analysis of heat source, types of metal transfer, weld pool characteristics, solidification mechanisms in fusion zone, heat affected zone characteristics, types of weld joint, distortion and residual stresses, weld defects, destructive and non-destructive testing of welds.

3. NON CONVENTIONAL MACHINING PROCESSES

Introduction and need of Non-conventional machining processes- Principle, Theory of material removal, process parameters, advantages, limitations and applications of Ultrasonic machining, Electro discharge machining, Laser beam machining and Electro chemical machining.

Special processes: Micro and Nano machining, molecular dynamic analysis, dry-electro discharge machining, electro discharge chemical machining, vacuum coating, Ballistic machining, unit head machining, hot machining.

4. ADVANCES IN MATERIAL FORMING

Macroscopic plasticity and yield criteria, plastic instability, strain rate and temperature, slab analysis, upper bound analysis, slip line field theory, plastic anisotropy, and numerical analysis of material forming processes.

5. SHEET METAL FORMING

Formability, bending, cupping, redrawing, ironing, complex stamping, metal spinning, stretch forming, fine blanking, high speed blanking.

6. NON CONVENTIONAL FORMING PROCESSES

High energy rate forming, electromagnetic forming, explosive forming, high speed hot forging, high velocity extrusion, high speed forming machines, peen forming, study of various process parameters.

REFERENCES

1. B.H. Amsteal, Philip F. Ostwald and Myron L. Begeman, “Manufacturing Processes", Wiley; 8th edition, ISBN-10: 0471842362, ISBN-13: 978-0471842361.
2. G.F. Benidict "Advanced Manufacturing processes", Marcel Dekker Publisher, Inc. New York (ISBN 0-8247-7352-7).
3. E. Paul DeGarmo, J. T. Black and Ronald A. Kohser, “Materials and Processes in Manufacturing”, Wiley; 9th edition, ISBN 9780471656531.
4. P. N. Rao, “Manufacturing Technology” Vol. 1- Foundry Forming & Welding; Tata Mc Graw Hill Publishing Co Ltd. ISBN: 9780070087989.
5. American Soc. For Metals, Metals Handbook, 10th Edition, Vol. 15, on Metal Forming, ASM, Metals Park, Ohio, 1989.
6. Raj, Shankar, Bhandari, “Welding Technology for Engineers”, Narosa Publication House Pvt. Limited.
7. Prashant P. Date “Introduction to Manufacturing Technologies”, Jaico Publishing House (2010) ISBN: 9788179929971

511104
Research Methodologies

Teaching Scheme	Examination Scheme
Lectures: 4 hrs/week	In semester: 50
Credits – 4	End semester: 50

1. INTRODUCTION

Nature and objectives of research. Methods of Research: historical, descriptive and experimental, research process, research approaches, criteria for good research, problems faced by researchers

2. RESEARCH DESIGN

Meaning of research design, need of research design, features of good design, different research designs, basic principles of experimental designs, design of experiments.

3. DATA COLLECTION

Types of data, methods and techniques of data collection, primary and secondary data, meta analysis, historical methods, content analysis, devices used in data collection, pilot study and pretest of tools, choice of data collection methods.

4. PROCESSING AND ANALYSIS OF DATA

Use of statistics for data analysis, measures of central tendency, dispersion, skewness and relationship. Sampling distributions, sampling theory, determination of sample size, chi-square test, analysis of variance, multiple regression analysis, neural networks.

5. DECISION MAKING TECHNIQUES

Multi-attribute decision making techniques: Analytical Hierarchy Process (AHP), TOPSIS, Data Envelope Analysis (DEA), graph theory and matrix approach.
Multi-objective decision making techniques: Simulated annealing, Genetic algorithms.

6. INTERPRETATION AND REPORT WRITING:

Techniques of interpretation, precautions in interpretation, significance of report writing, different steps in report writing, layout of research report, mechanics of writing research report.

REFERENCES

1. C.R Kothari “Research Methodology” Wishwa Prakashan, ISBN: 8173280363
2. P.G Triphati “Research Methodology” Sultan Chand & Sons, New Delhi.
3. J. W Barnes, “Statistical Analysis for Engineers and Scientists” McGraw Hill, New York. ISBN: 0078396085
4. Ranjit Kumar “Research Methodology” Pearson Education, ISBN: 9788131704967
4. R. V. Rao “Decision making in the manufacturing environment using graph theory and fuzzy multiple attribute decision making” Springer-Verlag, London. ISBN: 1846288193
5. Rao S. S., “Optimization”, Wiley Eastern, New Delhi, 1995. ISBN: 0471550345

6.Montgomery D.C., “Design and analysis of experiments”, John Wiley & Sons, ISBN: 0470128666.

511105 A

Reliability & Failure Analysis – Elective I 2013

Teaching Scheme	Examination Scheme
Lectures: 5 hrs/week	In semester: 50
Credits – 5	End semester: 50

1. INTRODUCTION

Basic Probability-concept and various distributions, Concept of Reliability and analysis of various configurations of assemblies and sub-assemblies. Series, Parallel and other grouping. System reliability, Set theory, optimal Cut Set and Tie Set, 'stardelta' method, matrix method etc.

2. PRODUCT FAILURE THEORY

System reliability determination through 'Event Tree' analysis and Fault Tree Analysis (FTA), Failure Modes and Effects Analysis (FMEA), Failure Modes, Effects and Criticality Analysis (FMECA). R.P.N, Graph theory, etc.

3. RELIABILITY PREDICTION MODELS

Series and parallel systems - RBD approach - Standby systems - m/n configuration -Application of Baye's theorem - cut and tie set method - Markov analysis. Optimal allocation of component reliability to achieve maximum system reliability -various techniques and methods such as Proportional, Conditional, Agree, Arinc, etc.

4. RELIABILITY EVALUATION

Concept of loading roughness, probability in design including evaluation of safety margin. Reliability of Engineering Design; Mean, Median & K statistics for Reliability evaluation (non parametric, Short Sample).

5. RELIABILITY MANAGEMENT

Reliability testing - Reliability growth monitoring - Non parametric methods - Reliability and life cycle costs - Reliability allocation - Replacement model.

6. CASE STUDIES

Diagnostic maintenance through ferrography, Vibration Signature, SOAP and other programme. Case studies done in Indian perspectives using Short Sample, nonparametric reliability

References

1. Gupta AK, “Reliability engineering and tero-technology”, Macmillan India Ltd, Delhi
2. Srinath L.S., “Mechanical Reliability” Affiliated East-West Press Pvt Ltd, Delhi. ISBN: 8176710296
3. O’Connor PDT, Practical Reliability Engineering, John Wiley & Sons Ltd, Singapore. ISBN:1119964091
4. Mohammad Modarres, Mark Kaminskiy, Vasiliy Krivtsov, "Reliability Engineering and Risk analysis ", Mara Dekker Inc., ISBN:0824720008.

5. John Davidson, The Reliability of Mechanical system, The Institution of Mechanical Engineers, London, ISBN:0852986750.

511105 B

MATERIALS TECHNOLOGY ELECTIVE I-2013

Teaching Scheme	Examination Scheme
Lectures: 5 hrs/week	In semester: 50
Credits – 4	End semester: 50

1. ELASTIC AND PLASTIC BEHAVIOUR

Elasticity in metals and polymers - Mechanism of plastic deformation, role of dislocations, Yield stress; 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 behaviours - Super plasticity - Deformation of non crystalline material.

2. FRACTURE BEHAVIOR

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.

3. 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.

4. MODERN METALLIC MATERIALS

Dual phase steels, Micro alloyed, High strength low alloy (HSLA) steel, Transformation induced plasticity (TRIP) steel, Maraging steel - Intermetallics, Ni and Ti aluminides,Smart materials, shape memory alloys - Metallic glass - Quasi crystal and nano crystalline materials, bio-materials.

5. NON METALLIC MATERIALS

Plastics, rubber, foams, adhesives and coatings - Structure, properties and applications of engineering polymers - Advanced structural ceramics, WC, TiC, TaC, AI2O3, SiC, Si3N4, CBN and diamond - properties, processing and applications.

6. COMPOSITE MATERIALS

Reinforced fibers, Particle strengthened and laminar composites-- production techniques of each type, Production of fibers, properties mechanics of composites, manufacturing of metal matrix, Ceramic matrix composite, Carbon-Carbon composite- properties and testing of composite material, areas of application.

REFERENCES:

1. Flinn, R. A. and Trojan P.K., “Engineering Materials and their Applications ", (4th Edition, 1990), Jaico Publishing House Publisher, ISBN: 8172246773.
2. George E. Dieter, “Mechanical Metallurgy ", McGraw Hill, 1988, ISBN 0-07-100406-8.
3. ASM Hand Book, Vol.11, “Failure Analysis and Prevention ".
4. Willam F. Smith, “Principles of Materials Science and Engineering”, 3rd edition, McGraw Hill, ISBN: 0070592411.
5. Mathew Philip, William Bolton “Technology of engineering materials” Butterworth-Heinemann, (2002), ISBN: 9780750656436.
6. Martin J. W. “Materials for Engineering” Institute of Materials, Minerals and Mining (2002), ISBN: 9781902653501

511105 C

Manufacturing Management ELECTIVE I 2013

Teaching Scheme	Examination Scheme
Lectures: 5 hrs/week	In semester: 50
Credits – 4	End semester: 50

1. SCOPE OF MANUFACTURING MANAGEMENT

History and development of Manufacturing Management - Contribution of various pioneers, overview of manufacturing systems, Manufacturing Management - Nature, Scope, Importance and Functions, Its relationship with other functions

2. PRODUCTION PLANNING & CONTROL

Functions of Production Planning & Control (PPC), Scheduling – Graphical and analytical techniques, Master Production Schedule, line balancing, Documentation - Production Work Order. Introduction to PERT/CPM, Network Crashing

3. ADVANCED TOPICS IN PRODUCTION MANAGEMENT

Concept of world-class manufacturing, Total quality management, manufacturing challenges of information age, JIT, lean and agile manufacturing, reconfigurable manufacturing, green production, computerized production management system, simulation of manufacturing systems

4. QUALITY MANAGEMENT

Foundations of quality management, Fundamentals of statistical studies, Tools and methods of analytic studies, stabilizing and improving a process with control charts, Process capability and improvement studies, inspection policy, Fork Model for Quality Management, Current thinking about statistical practice

5. MANUFACTURING STRATEGY

Need for manufacturing strategy (MS) and concept of MS, Structured strategy formulation, Focus of MS decisions relating to capability, flexibility, product variety, inventory, supplier relationships, manufacturable design. Role of Quality in the framework of MS-TQM, SPC, 6-sigma. Interface of marketing and manufacturing, financial aspects,Performance measurement in MS, Ingredients for a world-class manufacturing strategy, Contemporary cases from Indian manufacturing

6. GROUP DYNAMICS AND TEAM WORKING

Theories of Group Formation - Formal and Informal Groups, their interaction – Importance of teams - Formation of teams - Team Work. Conflict Management - Traditional vis-à-vis Modern view of conflict - Stress management, Conflict Process - Strategies for encouraging constructive conflict - Strategies for resolving destructive conflict.

REFERENCES

1. Fred Luthans, Organizational Behaviour, McGraw-Hill. ISBN: 0073404950

2. P. K. Saxena, “Principles of Management: A modern approach” Global India Publications. ISBN: 8190794159
3. Krajewski, “Operations Management” Pearson Education India. ISBN: 8131711315
4. Panneerselvam, Production & Operations Management. PHI New Delhi.
5. E. E. Adam, R. J. Ebert “Production & Operations Management” Prentice Hall. ISBN: 013717943X
6. Howard Gitlow, Alan Oppenheim, Rosa Oppenheim and David Levine, “Quality Management” (3rd Edition), Tata McGraw-Hill Publishing Company Ltd.
7. Eli Goldratt, “Critical Chain”, North River Press
8. John Nicholas,” Competitive Manufacturing Management”, McGraw-Hill Publishing Co.
9. V.K. Narayanan, “Managing Technology & Innovation for Competitive Advantage”

511105 D

Advanced Mechatronics - Elective-I 2013

Teaching Scheme	Examination Scheme
Lectures: 5 hrs/week	In semester: 50
Credits: 5	End semester: 50

1. INTRODUCTION

Introduction to Mechatronics - Systems - Mechatronics in Products – Measurement Systems - Control Systems -Traditional design and Mechatronics Design.

2. SENSORS AND TRANSDUCERS

Introduction - Performance Terminology - Displacement, Position and Proximity -Velocity and Motion – Fluid pressure - Temperature sensors - Light sensors - Selection of sensors - Signal processing - Servo systems.

3. MICROPROCESSORS IN MECHATRONICS

Introduction - Architecture - Pin configuration - Instruction set - Programming of Microprocessors using 8085 instructions - Interfacing input and output devices - Interfacing D/A converters and A/D converters –Applications - Temperature control - Stepper motor control - Traffic light controller.

4. PROCESS CONTROL COMPUTER SYSTEMS

Minis, micros, classification by hardware features and software facilities, performance evaluation techniques. Characteristics of Digital Processors: Organization, instruction set, characteristics for process control, input/output arrangements, addressing techniques, memory systems.

5. PROGRAMMABLE LOGIC CONTROLLERS

Introduction - Basic structure - Input / Output processing - Programming –Mnemonics Timers, Internal relays and counters - Data handling - Analog input / output - Selection of PLC.

6. DESIGN AND MECHATRONICS (MECHATRONIC PRODUCT DESIGN)

Designing - Possible design solutions - Case studies of Mechatronics systems.

REFERENCES

1. Michael B.Histand and David G. Alciatore, "Introduction to Mechatronics and Measurement Systems", McGraw-Hill International Editions, 1999.ISBN: 0070648142
2. Ramesh. S Gaonkar, “Microprocessor Architecture, Programming and Applications ", Wiley Eastern, 1998. ISBN:0130195707
3. Ghosh, P.K. and Sridhar, P.R., 0000 to 8085, "Introduction to Microprocessors for Engineers and Scientists ", Second Edition, Prentice Hall, ISBN:8120309782
4. Bolton, “Mechatronics: Electronic Control System in Mechanical and Electrical Engineering”, Pearson Education Ltd. ISBN:8131732533

5. Dr. Appukuttan, “Introduction to Mechatronics”, Oxford University Press, India, ISBN: 0195687817

511106
Lab Practice I 2013

Teaching Scheme	Examination Scheme
Practical: 4 hrs/week	Oral: 50 Marks
Credits – 4	TW: 50 Marks

Each student has to prepare a report based on ***any eight*** of the following laboratory work

1. Analysis of regenerative circuit.
2. Study of meter in and meter out circuit
3. Practical case study on evaluation of alternative hydraulic circuit design
4. Study of effect of process parameters for any non-traditional machining process
5. Experimental analysis of any one of the metal forming processes
6. Experimental analysis of casting process.
7. Industrial case study on design of experiment
8. Industrial case study on multi-attribute decision making
9. Numerical solution of a partial differential equation by using different methods
10. Manufacturing application of T test and Chi-square test.

511107

Computer Integrated Manufacturing

Teaching Scheme	Examination Scheme
Lectures: 4 hrs/week	In semester: 50
Credits-4	End semester: 50

1. COMPUTER AIDED DESIGN

Introduction to CAD, Display technologies, Graphic Standards, 2D and 3D Geometric transformations, analytic and synthetic curves (cubic and Bezier curves), analytic and synthetic surfaces (cubic, bilinear, and Bezier curves), solid modeling techniques, visual realism, computer animation, mechanical assembly, mass property calculations.

2. COMPUTER AIDED MANUFACTURING

Features of NC/CNC/DNC systems and its role in computer integrated manufacturing, CNC part programming, computer aided process planning, manual part programming with APT, NC program generation from CAD models, tool path generation and verification, standard controllers, digital manufacturing.

3. COMPUTER AIDED ENGINEERING ANALYSIS

Introduction to finite element analysis, need for finite element analysis in CAD/CAM system, Steps in finite element analysis, second order differential equation in one dimension applications such as discrete systems, heat transfer, fluid mechanics, plane trusses.

4. CIM DATABASE AND DATABASE MANAGEMENT SYSTEM

Database requirements of CIM, database management, Database management system (DBMS), DBMS architecture, product data management (PDM) and its advantages.

5. COMPUTER AIDED SHOP FLOOR CONTROL

Computer aided production planning and control, computer aided material requirement planning, factory data collection system, computer process monitoring, computer aided quality control. Fundamental of Networking

6. FLEXIBLE MANUFACTURING SYSTEMS (FMS)

Elements of FMS, subsystems, benefits, layout examples, Cellular manufacturing system, Indian scenario. Computer Integrated Manufacturing (CIM) models: ESPRIT-OSA, NIST AMRF, Siemens, DEC Enterprise optimization and present trends.

REFERENCES

1. Zeid Ibrahim “CAD/CAM Theory and Practices” McGraw Hill International Edition. ISBN: 0070151342
2. Regers and Adams “Mathematical elements for computer graphics” McGraw-Hill, 1990. ISBN: 0070535302
3. P. Radhakrishnan, S. Subramanyan, V. Raju “CAD/CAM/CIM” New age International Publishers, New Delhi. ISBN: 8122412483

4. Mikell P. Grover and Enory W. Zimmers Jr. “CAD/CAM: computer aided design and Manufacturing” Pearson Education, New Delhi. ISBN: 8177584162
5. Mikell P. Grover, “Automation, Production Systems and Computer-Integrated Manufacturing”, Pearson Education, New Delhi. ISBN: 0132393212
6. P.N. Rao “CAD/CAM: Principles and applications” Tata McGraw Hill, New Delhi. ISBN: 0070583730
7. P.N. Rao, N.K. Tewari, T.K. Kundra “Computer Aided Manufacturing” Tata McGraw Hill, New Delhi. ISBN: 9780074631034
8. Paul G. Ranky “Computer Integrated Manufacturing: an introduction with case studies” Prentice-Hall International. ISBN: 0131656554
9. J. N. Reddy “An Introduction to Finite element Methods” Tata McGraw Hill. ISBN: 0072466855
10. Nanua Singh “Systems approach to computer-integrated design and manufacturing” Wiley. ISBN: 0471585173
11. David D. Bedworth, Mark R. Henderson and Philip M. Wolfe “Computer Integrated design and Manufacturing”, McGraw-Hill, ISBN: 0070042047

511108

Tool & Die Design –2013

Teaching Scheme	**Examination Scheme**
Lectures: 4 hrs/week	In semester: 50
Credits – 4	End semester: 50

1. CUTTING TOOL DESIGN

Fundamentals of Cutting tools design, cutting tools and their principal elements, Tool geometry, system of nomenclatures and their interrelations, setting for the grinding of various basic cutting tool (turning, drilling, milling)

2. ANALYSES AND DESIGN OF JIGS AND FIXTURE

Principles of jig and fixture design, Dual cylinder location, diamond pin analysis, V-block analysis, design principles of centralizers, various mechanisms and design of equalizers, analysis for optimum number of clamping forces required and calculation of their magnitudes, concept of modular fixtures, design of fixtures for NC/CNC machines, computer applications in fixture design and analysis.

3. DESIGN OF PRESS TOOLS

Components of die design, design of die blocks, punches and strippers, methods of holding punches, sketches of stock stops, Design procedure for progressive dies, compound dies and combination dies for press tool operation forging die design for drop and machine forging parts. Computer applications in press tool design.

4. DESIGN OF FORGING DIES

Grain flow considerations, parting line selection, draft, design problems involving ribs, bosses and fillets. Flash and flash control, determination of number of impressions required and their sequence, design steps and analysis of forging dies, detail calculations, shrinkage, cavity shapes, heat transfer considerations, cooling and ejection systems, automation in forging operations, computer aided design and analysis.

5. DESIGN OF INJECTION MOLDS

Principles of melt processing, product considerations, determination of economical number of cavities, temperature control of injection molds, calculation of mold opening force and ejection force. Detail design of cooling system, ejection system and gating system. Moldability features, mold flow analysis.

6. DIE CASTING DIE DESIGN

Metals for die casting, specific details of die construction, casting ejectors, side cores, loose die pieces, slides, types of cores, directional solidification, types of feeders, die venting, water cooling, design aspects of die casting dies, defects.

REFERENCES

1. Amitabh Ghosh, A. K. Mallick “Manufacturing science” Prentice-Hall. ISBN: 0135526051,
2. H. W. Pollack “Tool Design” Prentice-Hall, ISBN: 0139251812
3. Donaldson: “Tool Design”, Tata McGraw Hill, ISBN: 0070992746
4. ASTEM: “Fundamentals of Tool Design”
5. P. C. Sharma: “A Textbook of Production Engineering” S. Chand Publication, New Delhi. . ISBN: 8121904218
6. Hoffman “Jigs & fixture design”, Thomson Delmar learning, USA. ISBN 1401811078,
7. Henriksen “Jigs & Fixture design manual” Industrial Press Inc. NY. ISBN: 0831110988,
9. P. H. Joshi “Press Tools: Design & Construction” S. Chand publication. ISBN: 8121929385
10. J. R. Paquin, R. E. Crowley “Die design fundamentals” Industrial Press Inc. NY. ISBN: 0831111720
11. S. A. Sheridan, “Forging Design Handbook” American Society for Metals, US.
12. Hiram Kenneth Barton, Lucy Clare Barton “Die casting die design”, Machinery Publication Co.
13. R. G. W. Pye “Injection mould design: a design manual for the thermoplastics industry” ISBN: 0711439060
14. Hans Gastrow “Injection Molds: 102 Proven Designs” Hansner. ISBN: 0029494400

511109

Advanced Joining Processes -2013

Lectures:4 hrs/week In semester: 50
Credits – 4 End semester: 50

1. INTRODUCTION

Importance and application of welding, classification of welding process. Selection of welding process, brief review of conventional welding process: Gas welding, Arc welding, MIG, TIG welding. Resistance welding. Electroslag welding, Friction welding etc. Welding of MS, CI, Al, Stainless steel & Maurer/Schaefflar Diagram. Soldering and Brazing.

2. ADVANCED WELDING TECHNIQUES

Principle and working and application of advanced welding techniques such as Plasma Arc welding, Laser beam welding, Electron beam welding, Ultrasonic welding etc.

3. WELD DESIGN

Welding machines/equipments and its characteristics and arc-stability, Weld defects and distortion and its remedies, Inspection/testing of welds, Weld Design, Welding of pipe-lines and pressure vessels. Life prediction.

4. METAL TRANSFER AND MELTING RATE

Mechanism and types of metal transfer, forces affecting metal transfer, modes of metal transfer, metal transfer in various welding processes, effective of polarity on metal transfer and melting rate.

5. THERMAL AND METALLURGICAL CONSIDERATION:

Thermal considerations for welding, temperature distribution, Analytical/Empirical analysis/formulae, heating & cooling curves. Metallurgical consideration of weld, HAZ and Parent metal, micro & macro structure. Solidification of weld and properties.

6. WELDING OF PLASTICS AND COMPOSITES

Principle of welding plastics, common weldable plastics, welding joint design, surface preparation, plastic welding processes, principle of operation, equipment required, Advantages, Applications.

REFERENCES:

1. R. S. Parmar, “Welding processes and technology”, Khanna Publishers, ISBN: 8174091262.
2. Raj, Shankar, Bhandari, “Welding Technology for Engineers”, Narosa Publication House Pvt. Limited.
3. S.V. Nandkarni, “Modern Arc Welding Technology”, Oxford and IDH publishing Co. Pvt. Ltd, New Delhi – 2010, ISBN: 9788120416765.
4. L.M. Gourd, “Principles of Welding Technology”, ELBS: E. Arnold, London, 2nd Edition, 1986, ISBN : 978-1-60525-797-6.

5. “Welding Handbook”, Vol. 1, 7th edition; American welding society. ISBN-13: 9780871711267.
6. Richard L. Little, “Welding and Welding Technology”, McGraw-Hill New York, [1973], ISBN: 0070380953, 9780070380950.

511110 A
Advanced Machine Tool Design- Elective-II 2013

Teaching Scheme	Examination Scheme
Lectures: 5 hrs/week	In semester: 50
Credits – 4	End semester: 50

1. INTRODUCTION

Introduction to Metal Cutting Machine tools, Kinematics, Basic Principles of Machine tool design, estimation of drive power. Design requirements of machine tools. Design approach for machine tools. Identification and quantification of objectives and constraints in machine tool design.

2. DESIGN OF STRUCTURAL COMPONENTS

Design of Machine tool spindle and bearings, Design of power Screws – Static deformation of various machine tool structures - thin walled box structures with open and compliant cross sections - correction coefficients - design of beds, columns, tables and supports. Dynamics of cutting forces - tool chatter - design of sideways.

3. DESIGN OF DRIVES

Design considerations of electrical, mechanical and Hydraulic drives in machine tool, stepped and step-less arrangements and systems. Design of control mechanisms - selection of standard components – Dynamic measurement of forces and vibrations in machine tools - Stability against chatter - use of vibration dampers.

4. DESIGN OF CNC MACHINE TOOL

CNC machine - block diagram showing memory, CPO, I/O, post processor, etc. Machining center, Auto tool changers, uses of Composites in machine tool. DNC and Local Area Network, machines with Adaptive Control. Design of slides with reinforced PTEE, Ball screw all design, methods of calculation of load, Reliability based design. Static and dynamic rigidity and stability analysis.

5. TESTING OF MACHINE TOOLS

Vibration study of machine tool structures – micro-displacement and error analysis of machine tools with reference to transmission system and positional displacement (stick slip). Acceptance tests and standardization of machine tools- machine tools reconditioning.

6. ERGONOMICS APPLIED TO MACHINE TOOL

Concepts of aesthetics and ergonomics applied to machine tools, Latest trends in Machine Tool Design, Introduction to CAD and Finite Element Method used in machine tool design.

REFERENCES:

1. Mehta N. K.,"Machine Tool design and Numerical Control",Tata McGraw Hill, 1989ISBN: 1259004570
3. Acherkan N., "Machine Tool Design",Vol.3 and 4,MIR Publishers, Moscow ISBN: 0898750474
4. Sen.G. and Bhattacharya, A., "Principles of Machine Tools",Vol.2,NCB.Calcutta, 1973 ISBN: 81-7381-155-5
5. Basu S. K. and Pal D. K., “Design of Machine Tools”, Oxford University Press, 2008 ISBN: 8120417216
6. Rao S. S., “The Finite Element Method in Engineering”, Elsevier Science and Technology Books, 2004, ISBN: 0750678283.

511110 B

Plastic Processing – Elective II 2013

Teaching Scheme	Examination Scheme
Lectures: 5 hrs/week	In semester: 50
Credits – 4	End semester: 50

1. PLASTIC MATERIALS

Classification of plastic materials, their physical and mechanical properties, selection of plastics for various applications, advantages and limitations of using plastics.

2. MELT PROCESSING TECHNIQUES

Polymer processing techniques such as extrusion, compression and transfer moulding, Injection moulding, blow moulding, thermoforming, rotational moulding, calendaring, Bag moulding reaction moulding. Effect of time, temperature and pressure on plastic processing.

3. CONSTRUCTIONAL FEATURES OF MOLD

constructional features of core and cavity plates, mold size and strength, cavity material, and fabrication, mold placement, constructional features and layout of runners and gates.

4. PRODUCT DESIGN OF MOLDED PRODUCTS

Various considerations such as wall thickness, fillets and radii, ribs, under, cuts, drafts, holes, threads, inserts parting lines, etc. surface treatment mould design for avoiding warpage. Standards for tolerances on molded articles.

5. DESIGN OF MOLDS FOR PLASTIC PROCESSING

Methodical mold design, determination of economical number of cavities, melt rheology, temperature control of injection molds, calculation of mold opening force and ejection force. Detail design of cooling system, ejection system and gating system. Moulding thermoplastics, thermosets, expandable polysterene, foamed engineering plastics, molds for reaction injection molding.

6. COMPUTER APPLICATIONS IN PLASTIC MOLDING

Use of various software for mold flow analysis, optimum gate location and defect analysis, design of component for balanced flow, optimization of process parameters of plastic molding.

REFERENCES

1. Edward A. Muccio “Plastic processing technology” ASM International.
2. Fried, “Polymer Science and Technology”, Prentice Hall. ISBN: 0136855613
3. Hans Gastrow “Injection Molds: 102 Proven Designs” Hansner. ISBN: 0029494400
4.A. S. Athalye “Plastics Materials Handbook” Multi Tech Publisher Mumbai.

511110 C

Supply Chain Management – Elective II 2013

Teaching Scheme	Examination Scheme
Lectures: 5 hrs/week	In semester: 50
Credits – 5	End semester: 50

1. INTRODUCTION

Objectives of Supply Chain Management (SCM), key components of supply chain i.e. sourcing, distribution strategy, customer service strategy; supply chain. Management as Integrated logistics, generic activities, architecture of supply chain, future potential of SCM.

2. SUPPLY CHAIN STRATEGIES

Evaluation of supply chain strategies, supply chain performance measures, vendor management, JIT, Link to supply chain, evaluation of SCM strategies, customer focus in SCM, inventory and logistics management, vendor management, Just-in- Time (JIT). Supply chain design considerations.

3. LOGISTIC MANAGEMENT

Logistical operation, integration, network design, logistical performance cycle, customer service global logistic, logistical resources, logistic planning.

4. WAREHOUSE AND TRANSPORT MANAGEMENT

Concept of strategic storage, warehouse functionality, warehouse operating principles, developing warehouse resources, material handling and packaging in warehouse, transportation management, transport functionality and principles, transport infrastructure, transport economics and pricing, transport decision making.

5. INVENTORY MANAGEMENT

Cost associated with inventory decisions, selective control, economic order quantity, safety stock and service level, P and Q system, probabilistic models.

6. Recent Trends in SCM

Tierisation of supplies, Reverse logistics, JIT II, Milk Round System (MRS), bar coding, Hub and Spoke Concept and other latest concepts. IT – enabled supply chain: Electronic data interchange, enterprise resource planning (ERP), Application of IT, Scope of emerging distributed cooperative tele-manufacturing over internet.

REFERENCES

1. Sunil Chopra, Peter Meindl, D.V. Kalra “Supply Chain Management” Pearson Education Asia, New Delhi. ISBN:9788131789209
2. Christopher “Logistics and Supply Chain Management” Pearson Education Asia, New Delhi. ISBN: 8177588346.

3. Donald B. “Logistic Management - The Integrated Supply Chain process” McGraw Hill, NY. ISBN: 0070068836.
4. D. Chandra bose “Inventory management” PHI Learning Pvt. Ltd., 2006, ISBN: 9788120328532.

511110 D

Product Life Cycle Management-Elective II- 2013

Teaching Scheme	Examination Scheme
Lectures: 5 hrs/week	In semester: 50
Credits – 4	End semester: 50

1. INTRODUCTION TO PLM

Need for PLM, opportunities and benefits of PLM, different views of PLM, components of PLM, phases of PLM, PLM feasibility study, PLM visioning.

PLM Strategies: Industrial strategies, strategy elements, its identification, selection and implementation, make – to - stock, assemble-to order, make- to order strategy, change management for PLM, Strategies for recovery at end of life, recycling.

Product Data Management (PDM): PDM systems and importance, reason for implementing a PDM system, financial justification of PDM, barriers to PDM implementation.

2. PRODUCT DESIGN

Engineering design, Industrial design, Generic product design process, Types of products, Product planning, Identify customer needs, product specifications, concept generation, concept selection, concept testing, prototyping, and product cost analysis.

3. APPROACHES FOR PRODUCT DESIGN

Mass customization, Kano model, Kansei engineering, conjoint analysis, Product architecture, Modular product architecture, product line design, product configuration, and concurrent engineering.

4. NEW PRODUCT DEVELOPMENT

Structuring new product development, need and importance of NPD Voice of customers(VoC), Methods of VoCs, Quality function deployment, building decision support system, Estimating market opportunities for new product, new product financial control, implementing new product development, product family, product mix, market entry decision, Market segmentation, launching and tracking new product program, concept of redesign of product, product development economics.

5. DESIGN FOR ‘X’

Design for manufacturing, Design for assembly, design for reliability, design for serviceability(maintainability),design for environment, design for safety, design for aesthetics, design guidelines for various casting process, injection molding, turning ,milling grinding, sheet metal working processes.

6. TECHNOLOGY FORECASTING

Future mapping, S-curve, invocating rates of technological change, methods of technology forecasting such as relevance trees, morphological methods and mission flow diagram, product design and process selection, product system-level design, product cannibalization and

petrification, use of academic research in product design, combining forecast of different technologies, human factors in product design, modeling and simulation in product design.

REFERENCES

1. K.T. Ulrich and S.D. Eppinger, Product design and development, Tata McGraw - Hill publishing, New Delhi, 2003,ISBN:007-247146-8
2. Dieter and Schmidt , Engineering Design,McGraw – Hill Higher education, ISBN: 978–0–07–283703–2
3. Saaksvuori Antii “Product life cycle Management”, Dreamtech Press, ISBN: 8184892705

511111

Lab Practice II

Teaching Scheme **Examination Scheme 2013**
Practical: 4 hrs/week In semester: 50
Credits – 5End semester: 50
Each student has to prepare a report based on following laboratory work.

1. Computer programming 3D transformations
2. Computer programming for synthetic curves/surfaces.
3. CNC part programming and machining
4. Simulation of manufacturing system
5. Finite element analysis for applications in heat transfer/fluid mechanics/plane trusses.Validation using FEM software.
6. Industrial applications for design and analysis of Jigs and fixture/Press Tools/Forging dies/Injection molds
7. Study of temperature distribution due to heat flow in welding
8. Determination of angular distortion in butt welded joints.

511112

Seminar I 2013

Teaching Scheme **Examination Scheme**
Practical: 4 hrs/week TW: 50 Marks
Credits – 4 Oral:50 Marks

Each student is required to deliver a Seminar on state of the art topic of his/her choice relevant to any area of Production Engineering and submit it in the form of short report.

611101

Advanced Robotics –2013

Teaching Scheme	Examination Scheme
Lectures: 4 hrs/week	In semester: 50
Credits – 4	End semester: 50

1. INTRODUCTION

Basic concepts - Robot anatomy - Robot configurations - Basic robot motions –Types of robots- Types of drives - Applications - Material handling - processing -Assembly and Inspection - safety considerations.

2. TRANSFORMATIONS AND KINEMATICS

Vector operations - Translational transformations and Rotational transformations – Properties of transformation matrices-Homogeneous transformations and Manipulator – Forward solution - Inverse solution.

3. CONTROLS AND END EFFECTORS

Control system concepts - Analysis - control of joints - Adaptive and optimal control – End effectors - Classification - Mechanical - Magnetic -Vacuum - Adhesive - Drive systems - Force analysis and Gripper design.

4. ROBOT PROGRAMMING

Methods - Languages -Computer control and Robot Software - VAL system and Language.

5. SENSORY DEVICES

Non optical and optical position sensors - Velocity and Acceleration - Range - Proximity -touch - Slip - Force - Torque - Machine vision - Image components - Representation -Hardware - Picture coding - Object recognition and categorization - Software consideration.

6. DESIGN OF MECHANISMS AND MANIPULATORS

Classification of closed- and open-loop kinematic systems, Definition of mechanisms and manipulators, Kinematic constraints, Degree of freedom (DOF) and Mobility; DH parameters, Coordinate transformations, Matrix methods; Structural analysis and synthesis of mechanisms; Forward kinematics of robot manipulators with examples; Inverse kinematics; Jacobian and singularity; Alternative design solutions of mechanisms and manipulators.

REFERENCES:

1. King Sun Fu, Gonzalez R.C., and Lee C.S.G., "Robotics: control, sensing, vision and intelligence", McGraw-Hill Book Co.
2. Klafter R.D., Chmielewski T.A. and Negin M., " Robot Engineering An Integrated approach", Prentice Hall of India, New Delhi, 1994.
3. Deb S.R., "Robotics Technology and Flexible Automation ", Tata McGraw-Hill Publishing Co., Ltd., 1994.
4. Craig J.J., "Introduction to Robotics Mechanics and Control ", Addison-Wesley.

5. Groover M.P., “Industrial robotics Technology, programming and applications ", McGraw-Hill Book Co., 1995.
6. Mittal and Nagrath, “Robotics & Control”, Tata McGraw-Hill.
7. Ashitava Ghoshal, “Robotics Fundamental Concepts & Analysis”, Oxford University Press.

611102
SURFACE ENGINEERING–2013

Teaching Scheme		Examination Scheme
Lectures: 4 hrs/week		In semester: 50
Credits: 4	End semester: 50	

1. INTRODUCTION OF SURFACE DEPENDENT PROPERTIES

Introduction to various corrosion prevention methods. Classification and scope of surface modification techniques in metals, ceramics, polymers and composites.Tailoring of surfaces of advanced materials. Surface dependent engineering properties, viz., wear, friction, corrosion, fatigue, reflectivity, emissivity, etc.; common surface initiated engineering failures; mechanism of surface degradation; importance and necessity of surface engineering

2 VARIOUS SURFACE CLEANING PROCESSES

Classification and Selection of Cleaning processes. Acid and Alkaline Salt bath, Ultrasonic, Mechanical cleaning, Pickling and descaling, etc. Process details, applications & Environmental concern of each.method, Electrochemistry and electro-deposition; electro less deposition Process details. Scope and application of conventionally deposited materials like Copper Nickel etc.

3 COATINGS

Various types like Cathodic &Anodic coatings, Hot dipping (Tinning, Galvanising,Aluminising), Metal cladding.Diffusion coatings like carburising, nitriding, cyaniding, Sherardising, Calorising & Chromosing. Chemical conversion coatings like Phosphate, Chromate, Oxide, Anodized. Various Organic coatings like Paints, varnishes, Enamel & Lacquers Thermal spray coatings-Various types like Flame spray, Electric arc spray, Plasma spray, High velocity Oxy Fuel (HVOF). Scope, Process and application; advantages and limitations of the above mentioned processes.

4. OTHER SURFACE ENGINEERING PROCESSES

Influence of manufacturing processes on various surface properties of an engineering component; scope of surface engineering in augmentation of surface properties. Other processes used in surface engineering – Physical vapour deposition, Chemical vapour deposition- Process and applications. Mass production-surface engineering problems related to substrate characteristics. Plasma enhanced Surface engineering, Ion Implantation. Diamond and Diamond like Carbon thin films and coatings for engineering surfaces.

5. TESTING & CHARACTERIZATION OF COATINGS

Control properties, response properties; surface geometry characterization Techniques(conventional and recent trends); coating thickness measurements – laboratory techniques and special techniques for accurate routine thickness measurements; adhesion measurement, conventional methods and recent developments;Quality assurance of coating process.

6. RECENT TRENDS IN SURFACE ENGINEERING

Measurement of mechanical properties of engineered surface in nano scale; Evaluation of tribological characteristics of engineered surface in macro, micro and nano scale, simulation of actual application environment in tribometer. High temperature coatings, Wear resistant coatings Use of Laser in Surface Engineering, Environmental protection issues.

REFERENCES

1. Bharat Bhushan, “Introduction to Tribology” John Wiley & Sons, ISBN: 0471158933
2. N.J. Persson, “Sliding Friction” Springer, 3540671927
3. Gwidon Stachowiak, A W Batchelor, “Engineering Tribology”, Butterworth-Heinemann, 0750678364
4. ASM Hand Book, Vol. 5, “Surface Engineering”.
5. Burakowski T,Wierzchon T. “Surface Engineering of Metals: Principles, Equipment, Technologies” CRC Press (1998) ISBN 9780849382253.

611103 A

Optimization Techniques - Elective III 2013

Teaching Scheme	Examination Scheme
Lectures: 5 hrs/week	In semester: 50
Credits – 5	End semester: 50

1. INTRODUCTION TO OPTIMIZATION

Statement of an optimization problem, classification. Introduction to optimization techniques, Engineering Applications

2. SINGLE VARIABLE OPTIMIZATION

Fabbonci search methods, golden section search methods, gradient based methods, Newton-Raphson method, secant method.

3. MULTI-VARIABLE OPTIMIZATION

Direct search methods: Evolutionary optimization method, Powell's conjugate direction method. Gradient based methods: Steepest descent method, Newton's method.

4. CONSTRAINED OPTIMIZATION

Constraint handling methods, method of feasible directions, generalized reduced gradient method, gradient projection method.

5. SPECIALIZED ALGORITHMS**:** Integer programming, geometric programming**.**

6. NON-TRADITIONAL OPTIMIZATION ALGORITHMS

Genetic algorithms (GA) - working principle, Differences and Similarities between GA's and traditional methods, GA's for constrained optimization. Simulated Annealing (SA) approach – introduction only.

References

1. Rao S S "Engineering Optimization: Theory and Practice", John Wiley & Sons. ISBN: 0470183527
2. Kalyanamoy Deb, "Optimization for Engineering Design: Algorithms and Examples", Prentice Hall of India, New Delhi. ISBN: 812030943X
3. A. D. Belegundu, T. R. Chandrupatla "Optimization Concepts and Applications in Engineering", Wiley Students Edition. ISBN: 0521878462
4. R. Fletcher, "Practical Methods of Optimization", John Wiley & Sons. ISBN: 0471494631

611103 B

Engineering Economics and costing-Elective III 2013

Teaching Scheme	Examination Scheme
Lectures: 5 hrs/week	Theory: 100 Marks
Duration: 3 hours	Credits – 4

1. INTRODUCTION TO ECONOMICS

Concept of Engineering Economics – Engineering efficiency, Economic efficiency, Scope of engineering economics, Managerial, Economics and Macro-economics - Applications of Economics, Elementary economic Analysis – Material and design selection criteria, Process planning.

2. FINANCIAL MANAGEMENT

Responsibilities and functions of financial management, financial analysis, ratio analysis, leverage analysis, budgeting and budgetory control, sources of finance for fixed and working capital.

3. INVESTMENT APPRAISAL METHODS

Types of investment appraisal methods – present worth method (Revenue dominated cash flow diagram), Future worth method (Revenue dominated cash flow diagram, cost dominated cash flow diagram), Annual equivalent method (Revenue dominated cash flow diagram, cost dominated cash flow diagram), rate of return method, make or buy decisions, Examples in all the methods, risk analysis.

4. REPLACEMENT AND MAINTENANCE ANALYSIS

Types of maintenance, types of replacement problem, determination of economic life of an asset, Replacement of an asset with a new asset – capital recovery with return and concept of challenger and defender, Simple probabilistic model for items which fail completely.

5. DEPRECIATION ANALYSIS

Introduction, Straight line method of depreciation, declining balance method of depreciation-Sum of the years digits method of depreciation, sinking fund method of depreciation/ Annuity method of depreciation, machine hour basis method, production unit method, joint factor rate method, annuity method, service output method of depreciation-Evaluation of public alternatives- introduction, Examples, Inflation adjusted decisions – procedure to adjust inflation, Examples on comparison of alternatives and determination of economic life of asset.

6. COSTING, COST CONTROL AND COST REDUCTION

Process costing: Elements of production cost in process costing, methods of process costing, principles of process costing.

Marginal costing: Features of marginal costing, significance of marginal costing, break even point, P/V ratio.

Standard costing and variance analysis: Direct material variances, direct labor variances, Overhaed variances, sales variances.
Cost control and cost reduction, Techniques of cost control, cost reduction, areas of application.

References:

1. Dominick Salvatore, “Managerial economics in a global economy” McGraw-Hill. ISBN: 0070545995
2. Panneer Selvam, R, Engineering Economics, Prentice Hall of India Ltd, New Delhi, 2001.ISBN: 8120317432
3. Sasmita Mishra, Engineering Economics and Costing. PHI Learning Pvt. Ltd. ISBN: 8120338936
4. Chan S.Park, “Contemporary Engineering Economics”, Prentice Hall of India, 2002. ISBN: 0136118488
5. William G. Sullivan, Elin Wicks and C.Patrick Koelling Engineering economy, Pearson Education, ISBN:9788131734421

611103 C

OCCUPATIONAL HEALTH & INDUSTRIAL SAFETY (ELECTIVE III) 2013

Teaching Scheme	Examination Scheme
Lectures: 5 hrs/week	In semester: 50
Credits – 4	End semester: 50

1. INDUSTRIAL SAFETY:

History of Safety Movement in India and abroad. “The Accident Problem”. Nature & size need for safety, legal, humanitarian, economic and social considerations. Safety Management: Role of management in Industrial Safety. Safety Management - Principles & Practices.

SAFETY EDUCATION AND TRAINING:

Training for Safety: Assessment of needs. Design & development of training programme. Training methods and strategies. Training of managers, supervisors & workers. Training Programme: In-Plant training, Out-of-plant training. Evaluation of training programmes, Seminars, Conferences & Workshop, Programmes for new workers. Job instructions Vs Safety instructions.

2. SAFEGUARDING OF MACHINES:

Statutory provisions related to safeguarding of machinery and working on/near unguarded machinery. Principles of machine guarding. Ergonomics of machine guarding. Type of guards. Guarding of different types of machinery: wood working, paper, rubber and printing machinery, Selection, maintenance and repair of guards. Incidental safety devices and methods.

MANUAL HANDLING AND STORAGE OF MATERIALS:

Basic principle of correct lifting and handling of materials. Avoidance of excessive muscular efforts. Maximum loads that may be carried. Lifting and carrying of objects of different shapes, size and weight. Safe use of accessories for manual handling. Storage of materials. Ergonomics of manual handling and storage.

3. MECHANICAL HANDLING OF MATERIALS

Lifting machinery: Safety aspects in design and construction, testing, use and care, signaling, inspection and maintenance Safety in design and construction, operation, Inspection and maintenance of power trucks and tractors, Lifts and hoists, lifting tackles, and loose gears, conveyors. Safety features, safe working load, destructive and non-destructive testing, inspection and maintenance of lifting tackles. The competent persons, duties and responsibilities under the various legislations.

WORKING AT HEIGHTS

High incidence of serious accidents in working at heights. Types of operations. Safety features associated with design. Construction and use of stairways, runs, ramps, gangways, floors, ladders of different types, scaffolds of different types including Boatswain’s chair and safety belts. Working on roofs, other safety requirements while working at heights. Prevention of fall of persons. Potential tripping and slipping hazards.

4. SAFETY AT WORK PLACE:-

Work place design: Concept of workplace and its design. Improving safety and productivity through work place design control measures. Technical and engineering control measures. Control measures against human error

PROVISIONS RELATING TO SAFETY & HEALTH**:** Indian Boilers Act and Regulations. Indian Electricity Act and Rules. Indian Explosives Act and Rules. Petroleum Act and Rules. Petroleum Act and Rules, MSIHC Rules, CIMAH Rules, Gas Cylinders Rules. Radiation Protection Act and Regulations. Static and mobile pressure vessels rules.

5. OCCUPATIONAL HEALTH

Common occupational diseases. Occupations involving risks of contracting these diseases. Mode of causation of the diseases and its effects. Diagnostic methods, Physiological tests in occupational health assessment. Methods of prevention. Compensation for occupational diseases. Evaluation of injuries. Industrial medical services unit and its functions. Occupational diseases of the lungs. Occupational dermatitis. Occupational cancer. Pre-employment and periodic medical examination of workers. Medical surveillance for control of occupational diseases. Health records, fundamentals of first-aid. Burns, fractures, suffocation, toxic ingestion, bleeding wounds. Artificial respiratory techniques bandaging.

6. PERSONAL PROTECTIVE EQUIPMENTS

(a) Non-respiratory personal protective devices: Head protection. Ear protection. Face and eye protection. Hand protection. Feet protection. Body protection. Supply, use care and maintenance of personal protective equipments. Training in the use of Non-respiratory Personal protective equipments, Requirements under the Factories Act and Rules. (b) Respiratory personal protective devices: Classification of hazards. Classification of respiratory personnel protective devices. Selection of respirators. Instructions and hints in the use of breathing apparatus. Supply, use, care and maintenance of breathing apparatus. Training in the use of respiratory personal protective devices.

REFERENCES

1. Heinrich H.W 'Industrial Accident Prevention' Mc Graw-Hill,
2. Encyclopedia of Occupational Health and Safety, edited by Jeanne Mager Stellman, International Labour office, Geneva
3. Heinrich H.W 'Accident Facts', 1977. National Safety Council, USA
4. Safety code for Scaffolds and Ladders, (Part II) – Ladders IS: 3696, (Part II) – 1966
5. 1979 Glossary of terms relating to wire ropes, IS 2363
6. 1977 Steel wire ropes for general engineering purposes, IS 2266
7.1964 Wire rope slings and sling legs, IS 2762
8. 1977 Steel wire suspension ropes for lifts, elevators and hoists, IS 2365
9. 1967 Code of practice for the selection, installation and maintenance of wire ropes IS 3973

10. Accident Prevention Manual for Industrial Operations National Safety Council444, North 11. Michigan Avenue, Chicago, I 11 – 60611
12. Encyclopedia of Occupational Health and Safety (ILO)
13. Model Code of Safety Regulation for Industrial Establishments (ILO)

611103 D

ENERGY MANAGEMENT -ELECTIVE III 2013

Teaching Scheme	Examination Scheme
Lectures: 5 hrs/week	In semester: 50
Credits – 4	End semester: 50

1. ENERGY SCENARIO

Global primary energy reserves and consumption pattern, Indian energy scenario, sector wise energy consumption, energy needs of growing economy, energy pricing in India, energy security importance of energy conservation and introduction of energy conservation act 2001.

2. ENERGY ECONOMICS AND ENERGY AUDIT

Energy economics: Simple payback period, time value of money, return on investment, net present value and internal rate of return. Energy Audit: Methodology, analysis and reporting, portable and online instruments required for energy audit, sankey diagram and specific energy consumption.

3. THERMAL SYSTEMS

Boiler efficiency calculations by direct and indirect method, various losses, steam distribution and steam traps, energy conservation opportunities in boiler. Efficiency calculation of oil fired furnace, heat losses and energy conservation opportunities in furnace. Thermal insulation, types of insulation, economic thickness of insulation.

4. ELECTRICAL SYSTEMS

Demand control, billing structure, power factor improvement, benefits and ways of improving PF, load scheduling, electric motors, losses and efficiency, energy efficient motor, speed control methods of motor, Lighting: illumination level, fixtures, timers, energy efficient illumination.

5. ENERGY CONSERVATION

Energy conservation in: Compressed air systems, refrigeration and air conditioning systems, pumps, fans, D. G. set and cooling tower.

6. COGENERATION AND WASTE HEAT RECOVERY

Cogeneration: Concept, technical options, classification of cogeneration system i.e. topping and bottoming cycle, selection criteria, applications. Waste Heat Recovery: Introduction, classification and applications, benefits, waste heat recovery equipments i. e. recuperator, regenerator, economizer, heat wheel, heat pipe, thermo-compressor, heat pump.

REFERENCES

1. Guide books 1, 2 and 3, Bureau of Energy Efficiency.
2. Practical Energy Audit Manual, Indo –German Energy Efficient Project, Tata Energy Research Institute (TERI).
3. Albert Thumann, Plant Engineers and Managers Guide to Energy Conservation, CRC Press.

4. I. G. C. Dryden , The Efficient Use of Energy, IPC Science and Technology Press.
5. S. C. Tripathy, Electric Energy Utilisation and Conservation, Tata McGraw-Hill Publishing Company Ltd.
6. P. H. Henderson: India- The Energy sector, Oxford University Press.
7. W. C. Turner, editor: The efficient use of energy (Butterworths)
8. Frank Keith, Yogi Goswami, “Enegy Management and End use Efficiency Handbook” Taylor and Francis.
9. Donald A. Wulfinghoff, Energy Efficiency Manual, Energy Institute Press.

611103 E

Intellectual Property Rights – Elective III

Teaching Scheme	**Examination Scheme**
Lectures: 3 hrs./week	Theory: 100 Marks
Duration: 3 hours	Credits – 3

1. INTRODUCTION TO IPR

Introduction – Invention and Creativity – Intellectual Property (IP) – Importance –Protection of IPR – Basic types of property-Movable Property - Immovable Property and - Intellectual Property.

2. PATENTS AND COPYRIGHTS

IP – Patents – Copyrights and related rights – Trade Marks and rights arising from Trademark registration – Definitions – Industrial Designs and Integrated circuits – Protection of Geographical Indications at national and International levels – Application Procedures.

3. INTERNATIONAL SCENARIO

International convention relating to Intellectual Property – Establishment of WIPO –Mission and Activities – History – General Agreement on Trade and Tariff (GATT) – TRIPS Agreement.

4. NATIONAL INTELLECTUAL PROPERTY POLICY

Indian Position Vs. WTO and Strategies – Indian IPR legislations – commitments to WTO-Patent Ordinance and the Bill – Draft of a national Intellectual Property Policy – Present against unfair competition.

5. CASE STUDIES

Case Studies on – Patents (Basmati rice, turmeric, Neem, etc.) – Copyright and related rights – Trade Marks – Industrial design and Integrated circuits – Geographic indications – Protection against unfair competition.

6. NEW DEVELOPMENTS IN IPR

New Developments in IPR, Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Softwares etc.

References:

1. Kankanala K. C., Narasani A. K. and Vinita Radhakrishnan V., "Indian Patent Law and Practice ", Oxford University Press, 2012, ISBN: 0198089600
2. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd, 2007, ISBN: 0415701279
3. Robert P. Merges, Peter S. Menell, Mark A. Lemley, "Intellectual Property in NewTechnological Age". ISBN: 9780735589131

611104

Seminar II

Teaching Scheme	**Examination Scheme**
Practical: 4 hrs/week	Term Work: 50 Marks
Credits – 4	Oral: 50 Marks

Each student is required to review the literature related to proposed dissertation work to be done.
He/she is required to deliver the seminar and submit it in the form of short report.

611105

Project Stage I 2013

Teaching Scheme	Examination Scheme
Practical: 4 hrs/week	Term Work: 50
Credits – 5	Oral: 50 Marks

Student has to submit a report based upon the following:

- Objective of the Project
- Progress Achieved
- Difficulties encountered
- Experimental set up preparation
- Methodology and data analysis
- Future plan of action

611106 Seminar III

Teaching Scheme	Examination Scheme
Practical: 5 hrs/week	Term Work: 50
Credits – 5	Oral: 50 Marks

Each student is required deliver a seminar based on proposed dissertation work to be done andsubmit it in the form of short report. The report should include analytical treatment andmathematical formulation of the problem identified for the dissertation work.

611107 Project Stage II

Teaching Scheme	Examination Scheme
Practical: 20 hrs/week	Term Work: 150
Credits – 20	Oral: 50 Marks

Student has to submit a report based upon the following:
1. Objectives of work
2. Review of literature
3. Development of methodology
4. Experimental and numerical analysis.
5. Results obtained.
6. Comparison of results with previous work done