



**SCSVMV UNIVERSITY**

**M.E. ENGINEERING DESIGN  
(FULL TIME)**

**CURRICULA AND SYLLABUS  
FOR  
I TO IV SEMESTERS**

**REGULATIONS 2009**

**DEPARTMENT OF MECHANICAL ENGINEERING  
SRI CHANDRASEKHARENDRA SARASWATHI VISWA MAHAVIDYALAYA**  
(Declared as Deemed-to-be University under Section 3 of the UGC Act, 1956,  
Vide notification No.F.9.9/92-U-3 dated 26<sup>th</sup> May 1993 of the Govt. of India)  
ENATHUR. KANCHIPURAM – 631 561

# CURRICULUM

## Semester: I

Code	Subject	No. of Hours				Exam Hours	Maximum marks		
		L	T	P/D	C		I	E	Tot.
EMCIM1DT051	Applied Materials engineering	3	1	-	3	3	40	60	100
EMCIM1DT052	CNC Machines	3	1	-	3	3	40	60	100
EMCIM1DT053	Computer Aided Design & Manufacturing	3	1	-	3	3	40	60	100
EMCIM1DE054 (A to B)	Elective – I	3	1	-	3	3	40	60	100
EMCIM1DT055	Manufacturing Information Systems	3	1	-	3	3	40	60	100
EMCIM1FT053	Probability & Statistical Methods	3	1	-	3	3	40	60	100
EMCIM1DP051	CIM Laboratory - I	-	-	6	2	3	40	60	100
<b>Total</b>		<b>18</b>	<b>6</b>	<b>6</b>	<b>20</b>		<b>280</b>	<b>420</b>	<b>700</b>

## Semester: II

Code	Subject	No. of Hours				Exam Hours	Maximum marks		
		L	T	P/D	C		I	E	Tot.
EMCIM2DT051	CIP & Inventory Systems	3	1	-	3	3	40	60	100
EMCIM2DT052	Robotics & Sensors	3	1	-	3	3	40	60	100
EMCIM2DT053	Metrology & Non Destructive Testing	3	1	-	3	3	40	60	100
EMCIM2DT054	System Modeling & Simulation	3	1	-	3	3	40	60	100
EMCIM2DE055 (C to D)	Elective – II	3	1	-	3	3	40	60	100
EMCIM2DE056 (E to F)	Elective – III	3	1	-	3	3	40	60	100
EMCIM2DP051	CIM Laboratory - II	-	-	6	2	3	40	60	100
<b>Total</b>		<b>18</b>	<b>6</b>	<b>6</b>	<b>20</b>		<b>280</b>	<b>420</b>	<b>700</b>

### Semester: III

Code	Subject	No. of Hours				Exam Hours	Maximum marks		
		L	T	P/D	C		I	E	Tot.
EMCIM3DE051 <b>G to I</b>	<b>Elective – IV</b>	3	1	-	3	3	40	60	100
EMCIM3DE052 <b>J to L</b>	<b>Elective – V</b>	3	1	-	3	3	40	60	100
EMCIM3DE053 <b>M to O</b>	<b>Elective – VI</b>	3	1	-	3	3	40	60	100
EMCIM3DP051	<b>Project Work Phase - I</b>	-	-	8	11	3	40	60	100
<b>Total</b>		<b>9</b>	<b>3</b>	<b>8</b>	<b>20</b>		<b>160</b>	<b>240</b>	<b>400</b>

### Semester: IV

Code	Subject	Credits	Maximum Marks		
			I	E	Tot.
EMCIM4DP051	<b>Project Work Phase - II</b>	<b>20</b>	<b>40</b>	<b>60</b>	<b>100</b>

**L** : Lecture Periods;

**P/D** : Practical / Drawing Periods;

**I** : Internal Assessment;

**Tot.** : Total marks

**T** : Tutorial Periods;

**C** : Credits

**E** : External Assessment;

## **LIST OF ELECTIVE SUBJECTS**

### **SEMESTER – I**

- EMCIM1DE054A - Design of Hydraulic and Pneumatic Systems
- EMCIM1DE054B - Supply Chain Management

### **SEMESTER – II**

- EMCIM2DE055C - Design of Cellular Manufacturing systems
- EMCIM2DE055D - Metal Forming Technology
- EMCIM2DE056E - Newer Welding and Casting Process
- EMCIM2DE056F - Finite Element Analysis in Manufacturing Engineering

### **SEMESTER – III**

- EMCIM3DE051 G - Reliability and total Productive Maintenance
- EMCIM3DE051 H - Mechatronics in Manufacturing System
- EMCIM3DE051 I - Computer Aided Process Planning
- EMCIM3DE052J - Corrosion and Surface Engineering
- EMCIM3DE052 K - Computer Applications in Manufacturing
- EMCIM3DE052 L - Tool Engineering
- EMCIM3DE053M - Plastics and Composite Materials
- EMCIM3DE053N - Total Quality System and Engineering
- EMCIM3DE053O - Advances in Manufacturing Technology

# SEMESTER - I

## EMCIM1DT051 - APPLIED MATERIALS ENGINEERING

### 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 behaviour - Super plasticity - Deformation of non crystalline material.

### 2.FRACTURE BEHAVIOUR

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.

### 5.NON METALLIC MATERIALS

Polymeric materials - Formation of polymer structure - Production techniques of fibres, foams, adhesives and coatings - Structure, properties and applications of engineering polymers - Advanced structural ceramics, WC,TiC, TaC, Al<sub>2</sub>O<sub>3</sub>, SiC, Si<sub>3</sub>N<sub>4</sub>, CBN and diamond - properties, processing and applications.

*References:*

1. *Thomas H.Courtney, " Mechanical Behaviour of Materials ", (2nd Edition), McGraw-Hill, 2000.*
2. *Charles J.A., Crane, F.A.A and Furness, J.A.G., " Selection and use of Engineering Materials ",(3rd Edition ), Butterworth-Heiremann, 1977.*
3. *Flinn, R.A. and Trojan, P.K., " Engineering Materials and their Applications ", (4th Edition),Jaico, 1999.*
4. *George E.Dieter, " Mechanical Metallurgy ", McGraw Hill, 1988.*
5. *Metals Hand Book, Vol.10, " Failure Analysis and Prevention ", (10th Edition), 1994.*

*Web References:*

1. [www.astm.org/labs/pages/131350.htm](http://www.astm.org/labs/pages/131350.htm)
2. [www.applied materials.com/carrers/agu-ei.html](http://www.applied materials.com/carrers/agu-ei.html).

# **EMCIM1DT052 - CNC MACHINES**

## **1.INTRODUCTION TO CNC MACHINE TOOLS**

Development of CNC Technology, principles, features, advantages, economic benefits, applications, CNC,DNC concept, classification of CNC Machine, types of control, CNC controllers, characteristics, interpolators.

## **2.STRUCTURE OF CNC MACHINE TOOL**

CNC Machine building, structural details, configuration and design, guideways - friction and anti friction and other types of guide ways, elements used to convert the rotary motion to a linear motion - Screw and nut, recirculating ball screw, planetary roller screw, recirculating roller screw, rack and pinion, torque transmission elements - gears, timing belts, flexible couplings, Bearings.

## **3.DRIVES AND CONTROLS**

Spindle drives - DC shunt motor, 3 phase AC induction motor, feed drives - stepper motor, servo principle, DC & AC servomotors. Open loop and closed loop control, Axis measuring system - synchro, synchro-resolver, gratings, moire fringe gratings, encoders, inductosyn, laser interferometer.

## **4.CNC PROGRAMMING**

Coordinate system, structure of a part program, G & M Codes, Manual part programming for Fanuc,Heidenhain, Sinumeric control system, CAPP, APT part programming using CAD/CAM, ParametricProgramming.

## **5.TOOLING AND MAINTENANCE OF CNC**

Cutting tool materials, carbide insets classification, qualified, semi qualified and preset tooling, tooling system for Machining centre and Turning centre, work holding devices, maintenance of CNC Machines.

*Text Book:*

1. *HMT, Mechatronics, Tata McGraw-Hill Publishing Company Limited, New Delhi, 1998.*

*References:*

1. *James Madison, " CNC Machining Hand Book ", Industrial Press Inc., 1996.*

2. *Steve Krar, Arthur Gill, " CNC Technology and Programming ", McGraw-Hill International Editions, 1990.*

3. *Berry Leathan - Jones, " Introduction to Computer Numerical Control ", Pitman, London, 1987.*

4. *Hans B.Kief, T.Fredericx Waters, " Computer Numerical Control ", MacMillan / McGraw-Hill, 1992.*

5. *Bernard Hodgers, " CNC Part Programming Work Book ", city and Guids / Macmillan, 1994.*

6. *David Gribbs, " An Introduction to CNC Machining ", Cassell, 1987.*

7. Sadasivan, T.A. and Sarathy, D, " Cutting Tools for Productive Machining ", Widia (India)Ltd., August 1999.
8. Radhakrishnan, P. " Computer Numerical Control Machines ", New Central Book Agency, 1992.
9. Peter Smid, " CNC Programming Hand Book ", Industrial Press Inc., 2000.

*Web References:*

1. <http://iesu5.ieem.ust.hk/dfaculty/ajay/courses/ieem215/lecs/CNC.html>
2. <http://CNC-router-laser-machine.com/machinery.html>



# **EMCIM1DT053 - COMPUTER AIDED DESIGN AND MANUFACTURING**

## **1.CAD / CAM HARDWARE / SOFTWARE**

Types of Computer systems - Input devices - Output devices - CAD/CAM Software - Graphics standards – Basic Definitions Modes of Graphics Operations -User Interface - Software modules- Modelling and Viewing - Software Development - Efficient use of CAD/CAM Software - Microcomputer based CAD/CAM.

## **2.TWO DIMENSIONAL AND THREE DIMENSIONAL TRANSFORMATIONS**

2D - Representation and Transformation of Points - Transformation of Lines -Rotation, Reflection, Scaling and combined transformations - 3Dscaling - shearing - Rotation - Reflection - Translation - Projections parametric representation of Ellipse, Parabola, Hyperbola.

## **3.MODELLING AND ANALYSIS**

Wire frame, Surface and Solid modelling - Solid modelling packages - Finite Element Analysis (FEA) -Introduction and procedures - Solution Techniques - Introduction to FEA packages.

## **4.COMPUTER AIDED MANUFACTURE**

Manufacturing Planning and Control - CAD/CAM Integration - Principles of Computer Integrated Manufacturing - Hierarchical Network of Computers - Local Area Networks - Process Planning – Computer Aided Process Planning - Retrieval and Generative approaches.

## **5.PRODUCTION PLANNING AND SHOP FLOOR CONTROL**

Computer Integrated Production Management System - Master Production Schedule - Material Requirement Planning - Inventory Management - Manufacturing and Design Data Base - Capacity Planning - Shop Floor Control - Functions - Order release - Order Scheduling - Order progress - Factory data collection.

### *References:*

1. Ibrahim Zeid, *CAD/CAM, " Theory and Practaice "*, Tata McGraw-Hill Ed., 1998.
2. David F.Rogers and Alan Adams.J, " *Mathematical Elements for Computer Graphics "* McGraw-Hill Publishing Company International Edition, 1990.
3. William M.Newman, Robert F.Sproull, " *Principles of Interactive Computer Graphics "*, McGraw-Hill International Book Company, 1984.
4. Groover M.P., *Automation, " Production Systems and Computer Integrated Manufacturing "*, Prentice-Hall of India Pvt.Ltd., New Delhi, 1996.
5. Paul G.Ranky, " *Computer Integrated Manufacture "*, Prentice-Hall International, UK, 1986.

### *Web References:*

1. [www.CADCAM-magazine.CO.UK](http://www.CADCAM-magazine.CO.UK).
2. [www.compinfo-center.com/compinfo/tt.nsf](http://www.compinfo-center.com/compinfo/tt.nsf).
3. [www.delcom.com](http://www.delcom.com)

# EMCIM1DT055 - MANUFACTURING INFORMATION SYSTEMS

## 1.INTRODUCTION

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

## 2.DATABASE

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

## 3.DESIGNING DATABASE

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

## 4.MANUFACTURING CONSIDERATION

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.

## 5.INFORMATION SYSTEM FOR MANUFACTURING

Parts oriented production information system - concepts and structure -computerised production scheduling, online production control systems, Computer based production management system, computerised manufacturing information system - case study.

### *References:*

1. Luca G. Sartori, " Manufacturing Information Systems ", Addison-Wesley Publishing Company, 1988.
2. Date.C.J., " An Introduction to Database systems ", Narosa Publishing House, 1997.
3. Orlicky.G., " Material Requirements Planning ", McGraw-Hill Publishing Co., 1975.
4. Kerr.R, " Knowledge based Manufacturing Management ", Addison-wesley, 1991.

### *Web Reference:*

1. [www.ist.psu.edu](http://www.ist.psu.edu)

## **EMCIM1FT053 - PROBABILITY AND STATISTICAL METHODS**

### **1.PROBABILITY AND RANDOM VARIABLES**

Probability - Random variables - Moments - Moment generating function - Standard distributions - Functions of random variables - Two dimensional R.Vs - Correlation and Regression.

### **2.ESTIMATION THEORY**

Principle of least squares - Regression - Multiple and partial correlations - Estimation of Parameters – Maximum likelihood estimates - Method of moments.

### **3.TESTING OF HYPOTHESIS**

Sampling distributions - Test based on Normal, t-distribution, Chi-square and F-distributions

### **4.DESIGN OF EXPERIMENTS**

Completely Randomized Design - Randomized Block design - Latin square design - 2 Factorial Design. Analysis of Variance - One way and Two way classifications.

### **5.TIME SERIES**

Characteristics and Representation - Moving Averages - Exponential smoothing - Auto Regressive Processes.

#### *References:*

1. *Fruend John, E. and Miller, Irwin , " Probability and Statistics for Engineering " , 5th Edition,Prentice Hall, 1994.*
2. *Jay, L. Devore, " Probability and Statistics for Engineering and Sciences ", Brooks/Cole Publishing Company Monterey, California, 1982.*
3. *Montgomery D.C and Johnson,L.A.," Forecasting and Time Series ", McGraw-Hill.*
4. *Anderson, O.D., " Time Series Analysis: Theory and practice ", I.North - Holland, Amsterdam, 1982.*
5. *Gupta, S.C. and Kapur, V.K." Fundamentals of Mathematical Statistics ", Sultan Chand and Sons, New Delhi, 1999.*

#### *Web Referenecs:*

1. [www.maths.adelaide.edu.AU/Applied/Courses/Hps.html](http://www.maths.adelaide.edu.AU/Applied/Courses/Hps.html).
2. [www.cs.cf.ac.UK/Dave/A12/nodes86.html](http://www.cs.cf.ac.UK/Dave/A12/nodes86.html).

## **EMCIM1DP051 - CIM LAB**

Computer Aided Drafting - Operating Systems - Wire Frame, Surface and Solid Modelling Simulation and Machining using CNC/DNC Machine Tools -Use of FEM packages - Relational Data Bases - Networking - Practice on Computer Aided Measuring Instruments - Image Processing - Software Development for Manufacturing - CNC Controllers - Use of advanced CNC Machine Packages - Business Data Processing.

# SEMESTER – II

## EMCIM2DT051 - CIP AND INVENTORY SYSTEMS

### 1.DEMAND FORECASTING

Characteristics and Principles, Methods, Qualitative Methods - Delphi technique, Market Research, Intrinsic method-time-series analysis, moving averages, exponential smoothing - The Bon Jenkins method, Extrinsic methods - Regression models, measurement of forecast errors.

### 2.INVENTORY MANAGEMENT

Functions of inventory - Objectives - Inventory systems - Inventory models - Basic and advanced inventory models.

### 3.PRODUCTION PLANNING

Purpose, Characteristics - Aggregate Planning - Methods - Master Production Scheduling - functions – Time buckets - time fences - Orders - Reports.

### 4.MATERIALS, REQUIREMENT PLANNING AND CAPACITY PLANNING

Purpose of MRP - Inputs to MRP - MRP LOGIC - Planning Factors - Outputs from MRP - Resource Planning - Capacity Planning.

### 5.CURRENT TRENDS

JIT- Supply Chain Management - Concurrent Engineering, MRP II, ERP.

#### *References:*

1. Lee J.Krajewski, Larry P.Ritzman, " Operations Management Strategy and Analysis Addison "- Wesley, 1999.
2. Spencer B.Smith, " Computer Based Production and Inventory Control ", Prentice Hall, 1989.
3. Joseph S.Martinkh, " Production and Operations Management ", John wiley & sons, 1999.
4. Joseph Monks, " Operations Management ", Theory and Practical, McGraw-Hill Publishing Company, 1987.
5. Nanu Singh, " Systems approach to computer-integrated design and Manufacturing ", John Wiley & Sons, 1996.

#### *Web Reference:*

1. <http://www.genex.co.th/Tech-update/DNS/scena102.htm>

# EMCIM2DT052 - ROBOTICS AND SENSORS

## 1.INTRODUCTION

Basic concepts - Robot anatomy - Robot configurations - Basic robot motions - 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.

### *References:*

1. Fu K.S., Gonzalez R.C., and Lee C.S.G., " Robotics control, sensing, vision, and intelligence ", McGraw-Hill Book Co., 1987.
2. Klafter R.D., Chmielewski T.A. and Negin M., " Robot Engineering An Intergrated 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, 1999.
5. Groover M.P., " Industrial robotics Technology, programming and applications ", McGraw-Hill Book Co., 1995.

### *Web Reference:*

1. <http://www.robotics.com>

# **EMCIM2DT053 - METROLOGY AND NON-DESTRUCTIVE TESTING**

## **1.MEASURING MACHINES**

Tool Maker's microscope - Co-ordinate measuring machines - Universal measuring machine - Laser viewers for production profile checks - Image shearing microscope - Use of computers - Machine vision technology - Microprocessors in metrology.

## **2.STATISTICAL QUALITY CONTROL**

Data presentation - Statistical measures and tools - Process capability - Confidence and tolerance limits – Control charts for variables and for fraction defectives - Theory of probability - Sampling - ABC standard – Reliability and life testing.

## **3.LIQUID PENETRANT AND MAGNETIC PARTICLE TESTS**

Characteristics of liquid penetrants - different washable systems - Developers - applications - Methods of production of magnetic fields - Principles of operation of magnetic particle test - Applications - Advantages and limitations.

## **4.RADIOGRAPHY**

Sources of ray-x-ray production - properties of d and x rays - film characteristics - exposure charts - contrasts -operational characteristics of x ray equipment - applications.

## **5.ULTRASONIC AND ACOUSTIC EMISSION TECHNIQUES**

Production of ultrasonic waves - different types of waves - general characteristics of waves - pulse echo method- A, B, C scans - Principles of acoustic emission techniques - Advantages and limitations - Instrumentation -applications.

### *References:*

1. JAIN, R.K. " *Engineering Metrology* ", Khanna Publishers, 1997.
2. Barry Hull and Vernon John, " *Non Destructive Testing* ", MacMillan, 1988.
3. American Society for Metals, " *Metals Hand Book* ", Vol.II, 1976.
4. *Progress in Acoustic Emission*, " *Proceedings of 10th International Acoustic Emission Symposium* ", Japanese Society for NDI, 1990.

### *Web References:*

1. [www.metrologytooling.com](http://www.metrologytooling.com)
2. [www.sisndt.com](http://www.sisndt.com)
3. [www.iuk'tu-harburg.de](http://www.iuk'tu-harburg.de)

# EMCIM2DT054 - SYSTEM MODELING AND SIMULATION

## 1.INTRODUCTION

Systems, modeling, general systems theory, concept of simulation, simulation as a decision making tool, types of simulation.

## 2.RANDOM NUMBERS

Pseudo random numbers, methods of generating random variates, discrete and continuous distributions, testing of random numbers.

## 3.DESIGN OF SIMULATION EXPERIMENTS

Problem formulation, data collection and reduction, time flow mechanism, key variables, logic flow chart, starting condition, run size, experimental design consideration, output analysis and interpretation validation.

## 4.SIMULATION LANGUAGES

Comparison and selection of simulation languages, study of any one simulation language.

## 5.CASE STUDIES/MINI PROJECT

Development of simulation models using the simulation language studied for systems like, queuing systems, production systems, Inventory systems, maintenance and replacement systems, investment analysis and network.

### *References:*

1. *Jerry Banks and John S.Carson, Barry L. Nelson, David M.Nicol, " Discrete event system simulation ", Prentice Hall, India, 2000.*
2. *Shannon, R.E. Systems simulation, " The art and science ", Prentice Hall, 1975.*
3. *Thomas J. Schriber, " Simulation using GPSS ", John Wiley, 1991.*



# ELECTIVES

## EMCIM1DE054A - DESIGN OF HYDRAULIC AND PNEUMATIC SYSTEMS

### REFER SYLLABUS FROM B.E

#### *References:*

1. Antony Esposito, " *Fluid power with Applications* ", Prentice Hall, 1980.
2. Dudleyt, A.Pease and John J.Pippenger, " *Basic Fluid Power* ", Prentice Hall, 1987.
3. Andrew Parr, " *Hydraulic and Pneumatics* ", (HB), Jaico Publishing House, 1999.
4. Bolton. W. " *Pneumatic and Hydraulic Systems* ", Butterworth - Heineman, 1997.

#### *Web References:*

1. [www.pneumatics.com](http://www.pneumatics.com)
2. [www.fluidpower.com.tw](http://www.fluidpower.com.tw)

# **EMCIM1DE054B - SUPPLY CHAIN MANAGEMENT**

## **1.INTRODUCTION**

Logistics - Concepts, Definitions, approaches, factors affecting logistics. Supply chain - basic tasks of the supply chain - the new corporate model.

## **2.SUPPLY CHAIN MANAGEMENT**

The new paradigm, the modular company, the network relations, supply process, Procurement process -Distribution management.

## **3.EVOLUTION OF SUPPLY CHAIN MODELS**

Strategy and structure - factors of supply chain - Manufacturing strategy stages, supply chain progress – model for competing through supply chain management - PLC grid, supply chain redesign - Linking supply chain with customer.

## **4.SUPPLY CHAIN ACTIVITY SYSTEMS**

Structuring the SC, SC and new products, functional roles in SC, SC design frame-work, collaborative product commerce (CPC).

## **5.SCM ORGANISATION AND INFORMATION SYSTEM**

The management task, logistics organisation, the logistics information systems - Topology of SC application - MRP, ERP, Warehouse management system, product data management - cases.

### *References:*

- 1. Scharj, P.B., Lasen,T.S., " Managing the global supply chain ", Viva books, New Delhi, 2000.*
- 2. Ayers, J.B., " Hand book of supply chain management ", The St.Lencie press, 2000.*
- 3. Nicolas, J.N., " Competeive manufacturing management-continuous improvement ", Lean production, customer focused quality, McGraw-Hill, NY, 1998.*
- 4. Steudel, H.J. and Desruelle, P., " Manufacturing in the ninetees-How to become a mean, lean and world class competitor ", Van Nostrand Reinhold, NY, 1992.*

# **EMCIM2DE055C - DESIGN OF CELLULAR MANUFACTURING SYSTEM**

## **1.INTRODUCTION**

Introduction to Group Technology, Limitations of traditional manufacturing systems, characteristics and design of groups, benefits of GT and issues in GT.

## **2.CMS PLANNING AND DESIGN**

Problems in GT/CMS - Design of CMS - Models, traditional approaches and non-traditional approaches - Genetic Algorithms, Simulated Annealing, Neural networks.

## **3.IMPLEMENTATION OF GT/CMS**

Inter and Intra cell layout, cost and non-cost based models, establishing a team approach, Managerial structure and groups, batch sequencing and sizing, life cycle issues in GT/CMS.

## **4.PERFORMANCE MEASUREMENT AND CONTROL**

Measuring CMS performance - Parametric analysis - PBC in GT/CMS, cell loading, GT and MRP - framework.

## **5.ECONOMICS OF GT/CMS**

Conventional Vs group use of computer models in GT/CMS, Human aspects of GT/CMS - cases.

### *References:*

- 1. Burbidge, J.L. Group " Technology in Engineering Industry ", Mechanical Engineering pub.London, 1979.*
- 2. Askin, R.G. and Vakharia, A.J., G.T " Planning and Operation, in the automated factory-Hand Book: Technology and Management ", Cleland, D.I. and Bidananda, B (Eds), TAB Books, NY, 1991.*
- 3. Irani, S.A. " Cellular Manufacturing Systems ", Hand Book.*
- 4. Kamrani, A.K, Parsaei, H.R and Liles, D.H. (Eds), " planning, design and analysis of cellular manufacturing systems ", Elsevier, 1995.*

# EMCIM2DE055D - METAL FORMING TECHNOLOGY

## 1.STRESS AND STRAIN

Three dimensional stress pattern-true stress and true strain-Principal stresses-Yield criteria-Vos Mises criterion- Tresca's criterion-Von Mises Yield for plane strain Problems-Coloumb function and sticking friction.

## 2.FORGING

Forging in Plane strain - Forging of circular disc - Effect of friction - Forging equipment - defects in forged products-Causes & Remedies.

## 3.ROLLING AND EXTRUSION

Rolling of sheet and strip in plane strain conditions - Effect of friction -maximum draft, rolling load, torque and H.P. - roll deflection - defect in rolled products - causes and remedies - forward and backward extrusion - Approximate extrusion loads - tube extrusion.

## 4.DRAWING

Rod and Wire drawing - Equilibrium equation - Strip drawing - tube drawing with out mandrel - Tube drawing with mandrel - Effect of friction and cone angle - Deflect in drawn parts.

## 5.UNCONVENTIONAL FORMING

High energy rate forming - Explosive forming - Magnetic Pulse forming -Electro hydraulic forming - Superplasticity - Powder metallurgy - Techniques - Applications.

### *References:*

1. Rao, P.N. " *Manufacturing Technology* ", Tata McGraw-Hill, 1991.
2. Avitzur, " *Metal Forming Processes and Analysis* ", McGraw-Hill, 1991.
3. Dieter, " *Mechanical Metallurgy* ", McGraw-Hill, 1996.
4. Harris, J.N., " *Mechanical working of Metals* ", *Theory and Practice*, Pergamon Press, 1995.
5. Tylour Altan, Soo-Ik-Oh and Harold L. Gegel - " *Americal Society for Metals* ", 1983

### *Web References:*

1. [www.kkai.com/matproc.html](http://www.kkai.com/matproc.html)

## **EMCIM2DE056E - NEWER WELDING AND CASTING PROCESSES**

### **1.WELDING METALLURGY**

Weld thermal cycles - Heat Affected Zone (HAZ) - Weldability of steels - Cast iron - Stainless steels, aluminium, copper and titanium alloys - Hydrogen embrittlement - Pre and Post weld heat treatments - Weld defects.

### **2.WELDING OF DISSIMILAR METALS**

Friction welding process - effects of speed and pressure - explosive welding -plasma arc welding - Electron beam welding - High frequency induction welding - Diffusion bonding - Cold pressure welding - Ultrasonic welding - Laser beam welding.

### **3.SAND CASTING**

Patterns - Moulding processes materials - Moulding processes equipment and mechanism - Molding sands -Cores - Core materials - Solidification of metals - Pouring and feeding of castings.

### **4.NON FERROUS CASTINGS**

Aluminium and Magnesium Foundry practice - Aluminium and Magnesium casting alloys - Copper alloy foundry - Copper-base casting alloys

### **5.FERROUS CASTINGS**

Steel castings - The family of cast iron - Melting of steels and cast irons - Grey iron foundry practice – Ductile iron - Malleable iron casting design considerations.

#### *References:*

1. Heine, Loper and Rosenthal, " Principles of Metal casting ", Tata McGraw-Hill, 1994.
2. American Society of Metals, " Source Book on Electron beam and laser beam welding ", 1987.
3. American Society of Metals, " Metals Hand Book ", 9th Edition, Vol.V, 1989.
4. American Society of Welding, " Hand book of Welding ", Vol.I to V.

#### *Web References:*

1. [www.technanalysis.com/die CAS](http://www.technanalysis.com/die CAS)
2. [www.manufacturing.net/magazine/purchasing/archives/1999/purl216-99/121mnew.htm](http://www.manufacturing.net/magazine/purchasing/archives/1999/purl216-99/121mnew.htm)

# EMCIM2DE056F - FINITE ELEMENT ANALYSIS IN MANUFACTURING ENGINEERING

## 1.INTRODUCTION

Basics of FEM - Initial value and boundary value problems - weighted residual, Galerkin and Raleigh Ritz methods - Review of Variational calculus -Integration by parts - Basics of variational formulation.

## 2.ONE DIMENSIONAL ANALYSIS

Steps in FEA - Discretization, Interpolation, derivation of element charecteristic matrix, shape function, assembly and imposition of boundary conditions - Solution and post processing - One dimensional analysis in solid mechanics and heat transfer.

## 3.SHAPE FUNCTIONS AND HIGHER ORDER FORMULATIONS

Global and Natural co-ordinates - Shape functions for one and two dimensional elements - Three noded triangular and four noded quadrilateral element - Non linear analysis - Isoparametric elements – Jacobian matrices and transformations - Basics of two dimensional axi symmetric analysis.

## 4.ANALYSIS OF PRODUCTION PROCESSES

FE analysis of metal casting - Special considerations, latent heat incorporation, gap element - Time stepping procedures - Crank - Nicholson algorithm - Prediction of grain structure - Basic concepts of plasticity - Solid and flow formulation - Small incremental deformation formulation - FE analysis of metal cutting, chip separation criteria, incorporation of strain rate dependency.

## 5.COMPUTER IMPLEMENTATION

Pre Processing, Mesh generation, element connecting, boundary conditions, input of material and processing characteristics - Solution and post processing - Overview of application packages such as ANSYS and DEFORM - Development of code for one dimensional analysis and validation.

### References:

1. Reddy, J.N. " *An Introduction to the Finite Element Method* ", McGraw-Hill, 1985.
2. Rao, S.S., " *Finite Element Method in Engineering* ", Pergammon Press, 1989.
3. Bathe, K.J., " *Finite Element Procedures in Engineering Analysis*, 1990.
4. Kobayashi, S, Soo-Ik-Oh and Altan, T, " *Metal Forming and the Finite Element Methods* ", Oxford University Press, 1989.
5. Lewis R.W., Morgan, K, Thomas, H.R., and Seetharaman, K.N., " *The Finite Element Method in Heat Transfer Analysis* ", JohnWiley, 1994.

### Web References:

1. [www.tbook.com](http://www.tbook.com)
2. [www.pollockeng.com](http://www.pollockeng.com)

# **EMCIM3DE051 G - RELIABILITY AND TOTAL PRODUCTIVE MAINTENANCE**

## **1.INTRODUCTION**

Reliability function - MTBF - MTTF - mortality curve - availability -Maintainability.

## **2.FAILURE DATA ANALYSIS**

Repair time distributions - exponential, normal, log normal, gamma, and Weibull - reliability data requirements -Graphical evaluation.

## **3.RELIABILITY PREDICTION**

Failure rate estimates - Effect of environment and stress - Series and Parallel systems - RDB analysis – Standby Systems - Complex Systems.

## **4.RELIABILITY MANAGEMENT**

Reliability demonstration testing - Reliability growth testing - Duane curve -Risk assessment - FMEA, Fault tree.

## **5.TOTAL PRODUCTIVE MAINTENANCE**

Causes of Machine Failures - Downtime - Maintenance policies - Restorability predictions - Replacement models- Spares provisioning -Maintenance management - Cleanliness and House Keeping.

### *References:*

- 1. Paul Kales, Reliability for technology, " Engineering and Management ", Prentice Hall, New Jersey, 1998.*
- 2. Modarres, " Reliability and Risk Analysis ", Meral Dekker Inc., 1993.*
- 3. Gopalakrishnan.P, and Banerji A.K., " Maintenance and Spare Parts Management ", Prentice Hall of India, New Delhi, 1996.*

# **EMCIM3DE051 H - MECHATRONICS IN MANUFACTURING SYSTEMS**

## **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.PROGRAMMABLE LOGIC CONTROLLERS**

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

## **5.DESIGN AND MECHATRONICS**

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

### *Text Books:*

1. Michael B.Histand and David G. Alciatore, " Introduction to Mechatronics and Measurement Systems", McGraw-Hill International Editions, 1999.
2. Bradley, D.A., Dawson, D, Buru, N.C. and Loader, AJ., " Mechatronics ", Chapman and Hall, 1993.
3. Ramesh.S, Gaonkar, " Microprocessor Architecture, Programming and Applications ", Wiley Eastern, 1998.
4. Lawrence J.Kamm, " Understanding Electro-Mechanical Engineering, An Introduction to Mechatronics ",Prentice-Hall, 2000.
5. Ghosh, P.K. and Sridhar, P.R., 0000 to 8085, " Introduction to Microprocessors for Engineers and Scientists ", Second Edition, Prentice Hall, 1995.

### *Web Reference:*

1. [www.cs.indiana.edu](http://www.cs.indiana.edu).



# **EMCIM3DE051 I - COMPUTER AIDED PROCESS PLANNING**

## **1.INTRODUCTION**

The Place of Process Planning in the Manufacturing cycle - Process Planning and Production Planning – Process Planning and Concurrent Engineering, CAPP, Group Technology.

## **2.PART DESIGN REPRESENTATION**

Design Drafting - Dimensioning - Conventional tolerancing - Geometric tolerancing - CAD - input / output devices - topology - Geometric transformation - Perspective transformation - Data structure – Geometric modelling for process planning - GT coding - The optiz system - The MICLASS system.

## **3.PROCESS ENGINEERING AND PROCESS PLANNING**

Experienced, based planning - Decision table and decision trees - Process capability analysis - Process Planning -Variant process planning - Generative approach - Forward and Backward planning, Input format, AI.

## **4.COMPUTER AIDED PROCESS PLANNING SYSTEMS**

Logical Design of a Process Planning - Implementation considerations -manufacturing system components, production Volume, No. of production families - CAM-I, CAPP, MIPLAN, APPAS, AUTOPLAN and PRO, CPPP.

## **5.AN INTERGARTED PROCESS PLANNING SYSTEMS**

Totally intergarted process planning systems - An Overview - Modulus structure - Data Structure, operation - Report Generation, Expert process planning.

### *References:*

- 1. Gideon Halevi and Roland D. Weill, " Principles of Process Planning ", A logical approach,Chapman & Hall, 1995.*
- 2. Tien-Chien Chang, Richard A.Wysk, "An Introduction to automated process planning systems ",Prentice Hall, 1985.*
- 3. Chang, T.C., " An Expert Process Planning System ", Prentice Hall, 1985.*
- 4. Nanua Singh, " Systems Approach to Computer Intergrated Design and Manufacturing ", John Wiley & Sons, 1996.*
- 5. Rao, " Computer Aided Mnuufacturing ", Tata McGraw Hill Publishing Co., 2000.*

### *Web References:*

- 1. <http://claymore.engineer.gusu.edu/jackh/eod/automate/capp/capp.htm>*
- 2. <http://Estraj.ute.sk/journal/engl/027/027.htm>*

# EMCIM3DE052J - CORROSION AND SURFACE ENGINEERING

## 1.MECHANISMS AND TYPES OF CORROSION

Principles of direct and Electro chemical corrosion, Hydrogen evolution and oxygen absorption mechanisms -Galvanic corrosion, Galvanic series -Specific types of corrosion such as, Uniform, pitting, Intergranular, Cavitation, Crevice, Fretting, Erosion and Stress corrosion - Factors influencing corrosion.

## 2.TESTING AND PREVENTION OF CORROSION

Corrosion testing techniques and procedures - Prevention of corrosion -Design against corrosion – Modification of corrosive environment - Inhibitors - Cathodic protection - Protective surface coatings.

## 3.CORROSION BEHAVIOUR OF MATERIALS

Corrosion of Steels, Stainless steels, Aluminium alloys, Copper alloys, Nickel and Titanium alloys - Corrosion of polymers, Ceramics and composite materials.

## 4.SURFACE ENGINEERING FOR WEAR AND CORROSION RESISTANCE

Diffusion coatings - Electro and Electroless plating - Hot dip coating - Hard facing - Metal spraying, Flame and Arc processes - Conversion coatings -Selection of coating for wear and corrosion resistance.

## 5.THIN LAYER ENGINEERING PROCESSES

Laser and Electron Beam hardening - Effect of process variables such as power and scan speed – Physical vapour deposition, Thermal evaporation, Arc vapourisation, Sputtering, Ion plating - Chemical vapour deposition -Coating of tools, TiC, TiN, Al<sub>2</sub>O<sub>3</sub> and Diamond coating properties and applications of thin coatings.

### *References:*

1. Fontana, G., " Corrosion Engineering ", McGraw-Hill, 1985.
2. Schweitzer P.A., " Corrosion Engineering Hand Book ", 3rd Edition, Marcel Decker, 1996.
3. Winston Revie, R,Uhlig's " corrosion, Hand Book ", 2nd Edition, JohnWiley, 2000.
4. Kammeth G. Budinski, " Surface Engineering for Wear resistance ", Prentice Hall, 1988.
5. Metals Handbook, Vol.5, " Surface Engineering ", ASM International, 1996.

### *Web References:*

1. [www.hw.ac.uk/mecwww/research/an/coserg-2.htm](http://www.hw.ac.uk/mecwww/research/an/coserg-2.htm)

# **EMCIM3DE052 K - COMPUTER APPLICATIONS IN MANUFACTURING**

## **1.PRE-PLANNING**

Introduction - Computer - Hardware and software -Types and systems organisation - Applications in Sales forecasting, Marketing - Cost and profit analysis.

## **2.PRODUCT CONCEPTS**

Product Design - Computer Application - Optimisation of product features and parameters - FEM and FEA Design for Quality and cost - Robust design through Computer programming.

## **3.PROCESS DESIGN AND ESTIMATION**

Process Design - Process planning and control - Tool design and selection -Related softwares - Computer aided MRP - Scheduling and control. Computer Aided MRP - Scheduling and Control.

## **4.COMPUTER AIDED TECHNIQUES**

CNC Machining - Machine tools machines - Micro machines - Precision Manufacturing systems - Part programming - CAD/CAM Interfacing. Computer Aided Inspection - CMM, AFM, Talysurf instruments - Quality control.

## **5.COMMUNICATION AND DEVELOPMENTS**

Net working system - Computer Aided communication - Feed back - Research and Development – Recent Developments - Design for productivity - Group technology - Cost estimation.

### *References:*

1. Grover, " CAD/CAM ", Prentice Hall.
2. Radhakrishnan, R., CIM, " New Central Book agency ".
3. Grahens T Smith, " CNC Machining Technology ", Springer, Verlag, 1993.I.
4. Pressman, R.S and Willaim, J.E., " Numerical contol and CAD ", John Wiley and Sons, Inc., NewYork, 1997.
5. Yoram Koran, " CNC Machines ".
6. Barry L.Jones, " Introduction to CNC ", John Wiley and Sons Inc., NewYork, 1988.

### *Web References:*

1. [www.intelitek.com/tek08computer.htm](http://www.intelitek.com/tek08computer.htm)
2. [www.isc.edu/mnftc/mnftc125.htm](http://www.isc.edu/mnftc/mnftc125.htm)

# EMCIM3DE052 L - TOOL ENGINEERING

## 1.MECHANICS OF MACHINING

Stereometry of cutting tools - Orthogonal and oblique cutting - Derivation of equation of forces - Shear plane angle - Merchants theory.

## 2.THERMAL ASPECTS OF MACHINING

Heat development in machining - Effects of various parameters -Measurement methods to determine Chip tool interface temperatures - Action of cutting fluids - Failure of cutting tools - Plastic failure - Brittle fracture – Wear machinability.

## 3.MACHINE TOOL VIBRATION

Types of machine tool vibration - self excited vibration - Avoidance of chatter and vibration - Stick slip motion -NC system stability.

## 4.ECONOMICS OF MACHINING PROCESSES

Costs associated with machining operations - Optimum cutting speed for minimum cost in turning – Optimum cutting speed for maximum profile rate -Effect of feed on cutting speed for minimum cost - Restriction on optimum cutting conditions - Effect of stochastic variability of work and tool properties - Optimization of multistage batch machining.

## 5.SPECIAL MACHINING

High pressure cutting - Deep hole reaming - Deep hole drilling - Gun drills -Gun boring - Trepanning - Honing - Lapping - Super finishing - Burnishing -Broaching - Surface broaching.

### References:

1. Juneja, B.L. and Sekhon, G.S., " *Fundamentals of Metal cutting and Machine tools* ", New Age International (P) Ltd., NewDelhi, 2000.
2. Bhattacharya, " *Metal cutiing Theory and Practice* ", Central Book Publishers, Calcutta, 1984.
3. Boothroyd, G., " *Fundamentals of Metal Machining and Machine Tools* ", McGraw-Hill Co., 1975.
4. Armarego E.J.A. and Brown R.H.," *The Machining of Metals* ", Prentice Hall of India, 1982.

### Web References:

1. [www.men10t00/.com/engwide](http://www.men10t00/.com/engwide)

# **EMCIM3DE053M - PLASTICS AND COMPOSITE MATERIALS**

## **1.INTRODUCTION**

Chemistry and Classification of Polymers - Properties of Thermo Plastics - Properties of Thermosetting Plastics - Applications - Merits and Disadvantages.

## **2.PROCESSING OF PLASTICS**

Extrusion - Injection Moulding - Blow Moulding - Compression and Transfer Moulding - Casting – Thermo Forming.

## **3.MACHINING AND JOINING OF PLASTICS**

General Machining properties of Plastics - Machining Parameters and Their effect - Joining of Plastics - Mechanical Fasteners - Thermal bonding - Press Fitting.

## **4.INTRODUCTION TO COMPOSITE MATERIALS**

Fibres - Glass, Boron, Carbon, Organic, Ceramic and Metallic Fibers - Matrix Materials - Polymers, Metals and Ceramics.

## **5.PROCESSING OF POLYMER MATRIX COMPOSITES**

Open Mould Processes, Bag Moulding, Compression Moulding with BMC and SMC - Filament winding - Pultrusion - Centrifugal Casting - Injection Moulding - Application of PMC's.

## **6.PROCESSING OF METAL MATRIX COMPOSITES**

Solid State Fabrication Techniques - Diffusion Bonding - Powder Metallurgy Techniques - Plasma Spray, Chemical and Physical Vapour Deposition of Matrix on Fibres - Liquid State Fabrication Methods - Infiltration - Squeeze Casting - Rheo Casting - Compocasting - Application of MMCS.

### *References:*

1. Harold Belofsky, *Plastics : " Product Design and Process Engineering*, Hanser Publishers, 1995.
2. Bera, E and Moet, A, " *High Performance Polymers* ", Hanser Publishers, 1991.
3. Hensen, F, " *Plastics Extrusion technology* ", Hanser Publishers, 1988.
4. Johannaber F, " *Injection Moulding Machines* ", Hanser Publishers, 1983.
5. Rauwendaal, C, " *Polymer extrusion* ", Hanser Publishers, 1990.
6. Rosatao, D.V., " *Blow Moulding Handbook*, Hanser Publisher, 1989.
7. Seamour, E.B., " *Modern Plastics Moulding* ", John Wiley.
8. John Dalmonte, " *Plastics Moulding* ", John Wiley.
9. Akira Kobayashi, " *Machining of Plastics* ", Mc-Graw Hill.
10. Krishan K.Chawla, " *Composite Materials science and Engineering* ", springer-Verlag, 1987.
11. Agarwal. D. and Broutman L.J., " *Analysis and Performance of Fiber Composites* ", Wiley, 1990.

12. Mallick, P.K. and Newman, S. " Composite Materials Technology ", Hanser Publishers, 1990.

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1. [www.innotech.ch/unsere-leistungen/gruppen/mec/Fvwo2\\_e.htm](http://www.innotech.ch/unsere-leistungen/gruppen/mec/Fvwo2_e.htm)

# **EMCIM3DE053N - TOTAL QUALITY SYSTEM AND ENGINEERING**

## **1.INTRODUCTION**

Principles of Quality Management - Pioneers of TQM - Quality costs - Quality system Customer Orientation -Benchmarking - Re-engineering - Concurrent Engineering.

## **2.PRACTICES OF TQM**

Leadership - Organisational Structure - Team Building - Information Systems and Documentation – Quality Auditing - ISO 9000 - QS 9000.

## **3.TECHNIQUES OF TQM**

Single Vendor Concept - J.I.T. - Quality Function deployment - Quality Circles - KAIZEN - SGA - POKA - YOKE - Taguchi Methods.

## **4.STATISTICAL QUALITY CONTROL**

Methods and Philosophy of Statistical Process Control - Control Charts for Variables and Attributes -Cumulative sum and Exponentially weighted moving average control charts - Others SPC Techniques – Process Capability Analysis - Six sigma accuracy.

## **5.ACCEPTANCE SAMPLING**

Acceptance Sampling Problem - Single Sampling Plans for attributes - double, multiple and sequential sampling, Military standards - The Dodge - Roming sampling plans.

### *References:*

1. *Mohamed Zairi, " Total Quality Management for Engineers ", Woodhead Publishing Limited 1991.*
2. *Harvid Noori and Russel, " Production and Operations mangament - Total Quality and Responsiveness ", McGraw-Hill Inc, 1995.*
3. *Suresh Dalela and Saurabh, ISO 9000 " A Manual for Total Quality Management ", S.Chand and Company Ltd., 1997.*
4. *John Bank, " The Essence of Total Quality Management ", Prentice Hall of India Pvt.Ltd., 1995.*
5. *Douglus C. Montgomery, " Introduction to Statistical Quality Control ", 2nd Edition, John Wiley and Sons, 1991.*
6. *Grant E.L and Leavensworth, " Statistical Quality Control ", McGraw-Hill, 1984.*

### *Web References:*

1. [www.ahepr.gov/research/feb00/02000RA15.htm](http://www.ahepr.gov/research/feb00/02000RA15.htm).
2. [www.mcb.co.uk/tam.htm](http://www.mcb.co.uk/tam.htm)

# **EMCIM3DE0530 - ADVANCES IN MANUFACTURING TECHNOLOGY**

## **1.METAL CUTTING AND TOOL MATERIALS**

Orthogonal and oblique cutting - Types of tool wear, Abrasion, Diffusion, Oxidation, Fatigue and Adhesive wear - Prediction of tool life - Monitoring of tool wear, Cutting forces and vibration - Tool materials, Cemented carbide, Coated carbide, Cermet, Ceramic, CBN and PCD - Selection of machine parameters and Tools.

## **2.SPECIAL MACHINING**

Deep hole drilling - Gun drills - Gun boring - Trepanning - Honing - Lapping - Super finishing - Burnishing -Broaching - High speed machining.

## **3.UNCONVENTIONAL MACHINING**

Principles, processes, Various influencing parameters and Applications of - Ultrasonic machining, Electro Discharge Machining, Electro Chemical Machining, Electron and Laser Beam Machining, Plasma Arc Machining and Water Jet Machining.

## **4.RAPID PROTOTYPING**

Stereolithography - Laminated object manufacturing - selective laser sintering - solid - Vacuum casting – Resin injection - Applications of RPT - Surface roughness terms - Influence of machining parameters on surface roughness - Micro finishing process.

## **5.ARTIFICIAL INTELLIGENCE AND EXPERT SYSTEMS**

Introduction - Pattern recognition - Control strategies - Heuristic search, Forward and Backward reasoning -Search algorithms - Game playing - Knowledge representation - structural representation of knowledge – Expert systems in manufacturing.

### *References:*

1. Armarego E.J.A. and Brown R.H., " *The machining of metals* ", Prentice Hall , 1982.
2. Battacharya," *Theory of metal cutting* ", NCB Agency, 1984.
3. HMT Manual, " *Non-traditional machining methods* ", 1975.
4. Rich E. and Knight K., " *Artificial Intelligence* ", McGraw Hill Inc, 1991.
5. Pham D.T., " *Expert Systems in Engineering* ", IFS Publishers, Springer-Verlag, 1988.
6. Durvent W.R., " *The Lithographic hand book* ", Narosa Publishers, 1995.
7. Pandey P.S. and Shah N. " *Modern Manufacturing Processes* ", 1980.
8. Sadasivan T.A. and Sarathy D. " *Cutting tools for Productive Machining* ", Widia (India) Limited, 1999.

### *Web References:*

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2. [www.mfgtech.org/publications/productivity-report.pdf](http://www.mfgtech.org/publications/productivity-report.pdf)



# IMAGE PROCESSING IN MANUFACTURING

## 1.INTRODUCTION

Image representation and nomenclature-Relationship of image processing and computer vision-Digital image fundamentals- Geometric model for imaging and applications-Imaging requirements.

## 2.IMAGE PROCESSING FUNDAMENTALS

Image transformers - Sampling-Enhancement-Restoration and conversions-Segmentation-Thresholding representation and description.

## 3.IMAGE ANALYSIS

Processing binary images-Image measurements - Multilevel image analysis-Higher dimensional modelling-Image based knowledge manipulation

## 4.PRACTICAL IMAGE PROCESSING

2D/3D Image acquisition-3D image Visualisation- Imaging surfaces-Image processing system components.

## 5.APPLICATION IN MANUFACTURING

Study of surface finish - Sorting and counting of objects -Tool Wear measurement, measurement technique - Robot application.

### *References:*

1. JOHN C RUSS - " *The Image Processing Hand Book,III Edition* " , CRC Press/IEEE Press,2000
2. ROBERT J SCHALKOFF -" *Digital Image Processing and Computer Vision* " , John Wiley & Sons Inc, 1998
3. RAFEL C, GON ZALEZ & RICHAR E WOODS - " *Digital Image Processing* " , Addison Wesley Publishing,1993.
4. RAMESH C JOHN - " *Introduction to machine vision* " , 1995,Tata Mc Graw Hill.