

108CCPT02

108CCPT02

COMPUTER APPLICATIONS IN DESIGN

3 0 2 100

1. INTRODUCTION TO COMPUTER GRAPHICS FUNDAMENTALS 10

Output primitives (points, lines, curves etc.), 2-D & 3-D transformation (Translation, scaling, rotators) windowing, view ports clipping transformation.

2. INTRODUCTION TO CAD SOFTWARE 10

Writing interactive programs to solve design problems and production of drawings, using any languages like Auto LISP/C/FORTRAN etc., creation of surfaces, solids etc., using solid modeling pack (prismatic and revolved parts).

3. VISUAL REALISM 10

Hidden - Line - Surface - solid removal algorithms shading - coloring. Introduction to parametric and variational geometry based software's and their principles creation of prismatic and lofted parts using these packages.

4. ASSEMBLY OF PARTS 8

Assembly of parts, tolerances analysis mass property calculations, mechanism simulation.

5. SOLID MODELING 7

Rapid prototyping - Data exchange - documentation - customizing solid modeling system.

Note: Lab Practice of 30 hrs. Total 45 + 30 - 75

References:

1. William M Neumann and Robert F.Sproul "Principles of Computer Graphics", Mc Graw Hill Book Co. Singapore, 1989.
2. Donald Hearn and M. Pauline Baker "Computer Graphics", Prentice Hall, Inc., 1992.
3. Mikell, P. Grooves and Emory W.Zimmers Jr. "CAD/CAM Computer - Aided Design and Manufacturing" Prentice Hall Inc., 1995.
4. Ibrahim Zeid "CAD/CAM - Theory and Practice" - McGraw Hill, International Edition, 1998.

ST' PETER'S UNIVERSITY
St' Peter's Institute of Higher Education & Research
Avadi, Chennai - 54
SEMESTER - I

~~108PET01~~

ME: CAD/CAM
Applied Mathematics

108CCPT01

1. **CALCULUS OF VARIATION** 9
Introduction - Euler's equation - several dependent variables Lagrange's equation of Dynamics - Integrals involving derivatives higher than the first - Problem with constraints - Direct methods and eigen value problems.
2. **MATRIX THEORY** 9
Eigen values using QR transformations - generalized eigenvectors - canonical forms - singular value decomposition and applications - pseudo inverse - least square approximations.
3. **LINEAR PROGRAMMING PROBLEM** 9
Graphical method - simplex method - Big M Technique - Integer programming.
4. **TESTING OF HYPOTHESIS** 9
Sampling distributions - Test based on Normal t-distribution. Chi-square and F-distributions - analysis of variance - One way and Two way classifications.
5. **TIME SERIES** 9
Characteristics and Representation - Moving Averages - Exponential smoothing - Auto Regressive Process.

REFERENCES :

1. Gupta, A.S, Calculus of Variations with Applications, Prentice - Hall of India New Delhi, 1997.
2. Bronson.R, "Matrix Operation" Schaums Outline Series, Mc Graw Hill, Newyork, 1989.
3. Taha H.A, " Operation Research, An Introduction", Prentice Hall of India, 2001.
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.

108 CEPT04

108PEPT04

INTEGRATED MECHANICAL DESIGN

3 0 0 100

(Use of Approved Data Book Is Permitted)

1. INTRODUCTION 6

Phases of design – Standardization and interchangeability of machine elements – Tolerances from process and function – Individual and group tolerances – Selection of fits for different design situations – Design for assembly and modular constructions – Concepts of integration.

2. SHAFTING 6

Analysis and Design of shafts for different applications – detailed design – preparation of production drawings – integrated design of shaft, bearing and casing – design for rigidity.

3. GEARS AND GEAR BOXES 18

Principles of gear tooth action – Gear correction – Gear tooth failure modes – Stresses and loads – Component design of spur, helical, bevel and worm gears – Design for sub assembly – Integrated design of speed reducers and multispeed gear boxes – application of software packages.

4. CLUTCHES 5

Integrated design of automobile clutches and over running clutches.

5. BRAKES 10

Dynamics and thermal aspects of vehicle braking – Integrated design of brakes for machine tools, automobiles and mechanical handling equipments.

Total 45

REFERENCES:

1. Newcomb, T.P. and Spur, R.T., "Automobile Brakes and Braking Systems", Chapman and Hall, 2nd Edition, 1975.
2. Juvinall, R.L.C., "Fundamentals of Machine Component Design", John Wiley, 1983.
3. Maitra G.M., "Hand Book of Gear Design", Tata McGraw Hill, 1985.
4. Shigley, J.E., "Mechanical Engineering Design", McGraw Hill, 1986.
5. Tech. P.S.G., "Design Data Book", Kalaikathir Achchagam, Coimbatore, 2003.
6. Lingaiah. K. and Narayana Iyengar, "Machine Design Data Hand Book", Vol. 1 & 2, Suma Publishers, Bangalore, 1983

WEB REFERENCE:

1. <http://agma.org/>

108CCPT03

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1. INTRODUCTION

10

Relevance of finite element analysis in design – Modeling and discretization
Interpolation, elements, nodes and degrees-of-freedom-applications of FEA

One-Dimensional Elements and Computational Procedures: Bar element – beam
element – bar and beam elements of arbitrary orientation – assembly of elements –
properties of stiffness matrices-boundary conditions-solution of equations-mechanical
loads and stresses-thermal loads and stresses-example problems.

2. BASIC ELEMENTS

10

Interpolation and shape functions - element matrices-linear triangular elements (CST)-
quadratic triangular elements – bilinear rectangular elements-quadratic rectangular
elements-solid elements-higher order elements-nodal loads-stress calculations-example
problems.

3. ISOPERIMETRIC ELEMENTS

8

Introduction-bilinear quadrilateral elements – quadratic quadrilaterals – hexahedral
elements – Numerical Integration – quadrature - static condensation – load considerations
– stress calculations – examples of 2D and 3D applications.

4. FINITE ELEMENTS IN STRUCTURAL DYNAMICS APPLICATIONS

9

Dynamic equations – mass and damping matrices – natural frequencies and modes –
damping – reduction of number of degrees-of-freedom-response history – model methods
– Ritz vectors – component mode synthesis – harmonic response – direct integration
techniques – explicit and implicit methods – analysis by response spectra – example
problems.

5. HEAT TRANSFER AND FLUID MECHANICS APPLICATIONS

8

Heat transfer – element formulation, – reduction-nonlinear problems-transient thermal
analysis-acoustic frequencies and modes-fluid structure interaction problems-plane
incompressible and rotational flows-example problems.

Total 45

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CAD LAB

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Exercises in Modeling and Analysis of Mechanical Components and assembly using Parametric and feature based Packages like PRO-E / SOLIDWORKS / CATIA / NX / ANSYS / NASTRAN etc.

Total 45

Equipments for CAD Lab

- | | | |
|---|---|--------|
| 1. CAD Workstations | : | 10 Nos |
| 2. CAD, 3D Modeling Software with assembly, mechanism simulation and drafting modules | : | 10 Nos |

ANALYSIS AND SIMULATION LAB

Analysis of Mechanical Components – Use of FEA packages, like ANSYS NASTRON etc., Exercises shall include FEA analysis of

- i) Machine elements under static loads
- ii) Heat transfer in mechanical systems
- iii) Determination of natural frequency
- iv) Axi-Symmetric
- v) Non-linear systems

Use of kinematics and dynamics simulation software like ADAMS software. Analysis of velocity acceleration for mechanical linkages of different mechanisms.

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~~108 DEPT 705~~ INDUSTRIAL ROBOTICS AND EXPERT SYSTEMS

3 0 0 100

1. INTRODUCTION AND ROBOT KINEMATICS 10

Definition need and scope of Industrial robots – Robot anatomy – Work volume – Precision movement – End effectors – Sensors.

Robot Kinematics – Direct and inverse kinematics – Robot trajectories – Control of robot manipulators – Robot dynamics – Methods for orientation and location of objects.

2. ROBOT DRIVES AND CONTROL 9

Controlling the Robot motion – Position and velocity sensing devices – Design of drive systems – Hydraulic and Pneumatic drives – Linear and rotary actuators and control valves – Electro hydraulic servo valves, electric drives – Motors – Designing of end effectors – Vacuum, magnetic and air operated grippers.

3. ROBOT SENSORS 9

Transducers and Sensors – Sensors in Robot – Tactile sensor – Proximity and range sensors – Sensing joint forces – Robotic vision system – Image Gribbing – Image processing and analysis – Image segmentation – Pattern recognition – Training of vision system.

4. ROBOT CELL DESIGN AND APPLICATION 9

Robot work cell design and control – Safety in Robotics – Robot cell layouts – Multiple Robots and machine interference – Robot cycle time analysis. Industrial application of robots.

5. ROBOT PROGRAMMING, ARTIFICIAL INTELLIGENCE AND EXPERT SYSTEMS 8

Methods of Robot Programming – Characteristics of task level languages lead through programming methods – Motion interpolation. Artificial intelligence – Basics – Goals of artificial intelligence – AI techniques – problem representation in AI – Problem reduction and solution techniques - Application of AI and KBES in Robots.

Total 45

TEXT BOOK:

1. K.S.Fu, R.C. Gonzalez and C.S.G. Lee, "Robotics Control, Sensing, Vision and Intelligence", Mc Graw Hill, 1987.

108CCPE01

108PEE01

FLEXIBLE COMPETITIVE MANUFACTURING SYSTEM

3 0 0 100

1. MANUFACTURING IN A COMPETITIVE ENVIRONMENT 9

Automation of manufacturing process - Numerical control - Adaptive control - material handling and movement - Industrial robots - Sensor technology - flexible, fixturing - Design for assembly, disassembly and service.

2. GROUP TECHNOLOGY 9

Part families - classification and coding - Production flow analysis - Machine cell design - Benefits.

3. FLEXIBLE MANUFACTURING SYSTEMS 9

Introduction - Components of FMS - Application workstations - Computer control and functions - Planning, scheduling and control of FMS - Scheduling - Knowledge based scheduling - Hierarchy of computer control - Supervisory computer.

4. COMPUTER SOFTWARE, SIMULATION AND DATABASE OF FMS 9

System issues - Types of software - specification and selection - Trends - Application of simulation - software - Manufacturing data systems - data flow - CAD/CAM considerations - Planning FMS database.

5. JUST IN TIME 9

Characteristics of JIT - Pull method - quality - small lot sizes - work station loads - close supplier ties - flexible work force - line flow strategy - preventive maintenance - Karban system - strategic implications - implementation issues - MRD JIT - Lean manufacture.

Total: 45

References

1. Groover M.P., " Automation, Production Systems and Computer Integrated Manufacturing ", Prentice-Hall of India Pvt. Ltd., New Delhi, 1996.
2. Jha, N.K. " Handbook of Flexible Manufacturing Systems ", Academic Press Inc., 1991.
3. Kalpakjian, " Manufacturing Engineering and Technology ", Addison-Wesley Publishing Co., 1995.
4. Taiichi Ohno, Toyota, " Production System Beyond Large-Scale production ", Productivity Press (India) Pvt. Ltd., 1992.

Web Reference

1. <http://www.engineeringtalk.com/news/lvd103.htm>

108CCPT06

~~108CCPT02~~

~~108DEE02~~ TOTAL QUALITY MANAGEMENT 3 0 0 100

1. CONCEPT OF TQM 9

Philosophy of TQM, Customer focus, organization, top management commitment, teamwork, Quality philosophies of Deming, Crosby and Muller.

2. TQM PROCESS 9

QC tools, problem solving methodologies, new management tools, work habits, quality circles, bench marking, strategic quality planning.

3. TQM SYSTEMS 9

Quality policy deployment, quality function deployment, standardization, designing for quality, manufacturing for quality.

4. QUALITY SYSTEM 9

Need for ISO 9000 system, advantages, clauses of ISO 9000, Implementation of ISO 9000, quality costs, quality auditing, case studies.

5. IMPLEMENTATION OF TQM 9

Steps in KAIZEN, 5S, JIT, POKAYOKE, Taguchi methods, case studies.

Total No of periods: 45

REFERENCES:

1. Rose., J.E. " Total Quality Management ". Kogan Page Ltd., 1993.
2. John Bank, " The Essence of total quality management ", PHI 1993.
3. Greg Bounds, Lyle Yorks et al, " Beyond Total Quality Management ", McGraw Hill, 1994.
4. Takashi Osada, The 5S's The Asian Productivity Organizations, 1991.
5. Masaki Imami, KAIZEN, McGraw Hill, 1986.

108 CCPE03

~~1081EE03~~ MAINTENANCE MANAGEMENT

3 0 0 100

1. INTRODUCTION 9

Maintenance functions - Tern technology -Maintenance costs - Organization for maintenance - Japanese concept.

2. RELIABILITY ANALYSIS 9

Reliability function - useful life - repair time distribution - Weibull application - Standby systems - Maintainability and availability - RCM.

3. MAINTENANCE POLICIES 9

Maintenance types - Preventive maintenance - PM for functional characteristics and large scale systems - repair policy - PM and break down maintenance - Statistical applications - replacement models.

4. LOGISTICS 9

Spare parts control - overall/optimum availability - Maintenance planning - priority rules - Maintenance staffing - UMS -Maintenance manual.

5. ADVANCED TECHNIQUES 9

Condition monitoring - WDM, SPM, Vibration monitoring - Maintenance information system - TPM - Maximize equipment effectiveness.

Total No of periods 45

References

1. Edward Hartman, "Maintenance Management", Productivity and Quality Publishing Pvt. Ltd., Madras, 1995.
2. Smith D.J. "Reliability and Maintainability in perspective", Mac Millan Ltd., London, 1985.
3. Seiichi Nakagrima, "Introduction to Total Productive Maintenance", Productivity press (India) Pvt. Ltd., 1993.

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Semester - II

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~~208CCPT01~~ MECHANICAL VIBRATIONS

1. FUNDAMENTALS OF VIBRATION 8

Review of Single degree freedom systems – Response to arbitrary periodic Excitations – Duhamel's Integral – Impulse Response function – Virtual work – Lagrange's equation – Single degree freedom forced vibration with elastically coupled viscous dampers – System Identification from frequency response – Transient Vibration – Laplace transformation formulation.

2. TWO DEGREE FREEDOM SYSTEM 8

Free vibration of spring-coupled system – mass coupled system – Vibration of two degree freedom system – Forced vibration – Vibration Absorber – Vibration isolation.

3. MULTI-DEGREE FREEDOM SYSTEM 12

Normal mode of vibration – Flexibility Matrix and Stiffness matrix – Eigen values and eigen vectors – orthogonal properties – Modal matrix-Modal Analysis – Forced Vibration by matrix inversion – Modal damping in forced vibration – Numerical methods for fundamental frequencies.

4. VIBRATION OF CONTINUOUS SYSTEMS 8

Systems governed by wave equations – Vibration of strings – vibration of rods – Euler Equation for Beams – Effect of Rotary inertia and shear deformation – Vibration of plates.

5. EXPERIMENTAL METHODS IN VIBRATION ANALYSIS 9

Vibration instruments – Vibration exciters Measuring Devices – Analysis – Vibration Tests – Free and Forced Vibration tests. Examples of Vibration tests – Industrial, case studies.

Total 45

REFERENCES:

1. Thomson, W.T. – "Theory of Vibration with Applications", CBS Publishers and Distributors, New Delhi, 1990.
2. Rao, J.S., & Gupta, K. – "Ind. Course on Theory and Practice Mechanical Vibration", New Age International (P) Ltd., 1984.
3. Den Hartog, J.P., "Mechanical Vibrations," Dover Publications, 1990.
4. Rao, S.S., "Mechanical Vibrations," Addison Wesley Longman, 1995.

WEB REFERENCES:

1. <http://www.ecgcorp.com/velav/>
2. <http://www.auburn.edu/isvd/>
3. www.vibetech.com/techpaper.htm

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1. ELASTIC AND PLASTIC BEHAVIOUR

10

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 solution strengthening, grain boundary strengthening, poly phase mixture, precipitation, particle, fiber and dispersion strengthening. Effect of temperature, strain and strain rate on plastic behaviors - Super plasticity - Deformation of non-crystalline material

2. FRACTURE BEHAVIOUR

10

Griffith 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

10

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

4. MODERN METALLIC MATERIALS

7

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

8

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

Total No. of Hours: 45

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208 DEPT02

INTERGRATED MANUFACTURING SYSTEM

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1. INTRODUCTION 5

Objectives of a manufacturing system-identifying business opportunities and problems classification production systems-linking manufacturing strategy and systems analysis of manufacturing operations.

2. GROUP TECHNOLOGY AND COMPUTER AIDED PROCESS PLANNING 10

Introduction-part families-parts classification and coding - group technology machine cells-benefits of group technology. Process planning function CAPP - Computer generated time standards.

3. COMPUTER AIDED PLANNING AND CONTROL 10

Production planning and control-cost planning and control-inventory management-Material requirements planning (MRP)-shop floor control-Factory data collection system-Automatic identification system-barcode technology- automated data collection system.

4. COMPUTER MONITORING 10

Types of production monitoring systems-structure model of manufacturing process-process control & strategies- direct digital control-supervisory computer control-computer in QC - contact inspection methods non-contact inspection method - computer-aided testing - integration of CAQC with CAD/CAM.

5. INTEGRATED MANUFACTURING SYSTEM 10

Definition - application - features - types of manufacturing systems-machine tools-materials handling system- computer control system - DNC systems manufacturing cell.

Flexible manufacturing systems (FMS) - the FMS concept-transfer systems - head changing FMS - variable mission manufacturing system - CAD/CAM system - human labor in the manufacturing system-computer integrated manufacturing system benefits.

Rapid prototyping - Artificial Intelligence and Expert system in CIM.

Total No of periods: 45

TEXT BOOKS:

1. Groover, M.P., "Automation, Production System and CIM", Prentice-Hall of India, 1998.

REFERENCES:

1. David Bedworth, "Computer Integrated Design and Manufacturing", TMH, New Delhi, 1998.
2. Yorem Koren, "Computer Integrated Manufacturing Systems", McGraw Hill, 1983.
3. Ranky, Paul G., "Computer Integrated Manufacturing", Prentice Hall International 1986.
4. R.W. Yeomamas, A. Choudry and P.J.W. Ten Hagen, "Design rules for a CIM system", North Holland Amsterdam, 1985.

208CCPT04

~~208DEPT04~~ INTEGRATED PRODUCT AND PROCESSES DEVELOPMENT

3 0 0 100

1. INTRODUCTION

9

Characteristics of Successful Product Development-Who Designs and Develops Products-Duration and Costs of Product Development- Challenges of Product Development -Development Processes and Organizations-A Generic Development Process-Concept Development: The Front-End Process Adapting the Genetic Product Development Process- Product Development Process Flows-The AMF Development Process-Product Development Organizations-The AMF Organization

2. PRODUCT PLANNING

9

Product Planning Process- Identify Opportunities- Evaluating and Prioritizing Projects- Allocating Resources and Timing- Pre-Project Planning-Reflect on the Results and the Process-Identifying Customer Needs- Raw Data from Customers- Interpreting Raw Data in Terms of Customer Needs-Organizing the Needs into a Hierarchy-Establishing the Relative Importance of the Needs-Reflecting on the Results and the Process

3. PRODUCT SPECIFICATIONS

9

What Are Specifications -When Are Specifications Established-Establishing Target Specifications-Setting the Final Specifications-Concept Generation-The Activity of Concept Generation-Clarify the Problem- Search Externally-Search Internally-Explore Systematically- Reflect on the Results and the Process.

4. CONCEPT SELECTION

9

Concept Selection- Overview of Methodology-Concept Screening-Concept Testing- Define the Purpose of the Concept Test- Choose a Survey Population- Choose a Survey Format- Communicate the Concept- Measure Customer Response-Interpret the Results- Reflect on the Results and the Process

5. PRODUCT ARCHITECTURE

9

Product Architecture-Implications of the Architecture-Establishing the Architecture-Delayed Differentiation-Platform Planning-Related System-Level Design Issues

Total 45

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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-Heinemann, 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
2. www.appliedmaterials.com/carrers/agu-ei.html.

Simulation and Machining using CNC / DNC Machine Tools – Use of FEM Packages -
 Relational Data Base – Networking – Practice on Computer Aided Measuring
 Instruments - Image Processing – Software Development for Manufacturing – CNC
 Controllers – Use of advanced CNC Machining Packages – Business Data Processing.

Total 45

Equipments for CAM Lab

- | | | | |
|----|---|---|--------|
| 1. | CAM Software for tool path generation for planer machining, contour machining, drilling, turning etc. & post processing modulus for different CNC controllers | : | 10 Nos |
| 2. | Medium production type CNC turning center with popular industrial type controller | : | 1 |
| 3. | Medium production type CNC machining center with popular industrial type controller | : | 1 |
| 4. | Bench Model CMM | : | 1 |
| 5. | Vision & image processing software | : | 2 |
| 6. | Data Processing Software | : | 2 |

208CCPT05

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~~208CCPT01~~ INDUSTRIAL SAFETY MANAGEMENT

3 0 0 100

1. SAFETY MANAGEMENT 9

Evaluation of modern safety concepts - Safety management functions - safety organization, safety department - safety committee, safety audit - performance measurements and motivation - employee participation in safety - safety and productivity.

2. OPERATIONAL SAFETY 9

Hot metal Operation - Boiler, pressure vessels - heat treatment shop - gas furnace operation - electroplating-hot bending pipes - Safety in welding and cutting. Cold-metal Operation - Safety in Machine shop - Cold bending and chamfering of pipes - metal cutting - shot blasting, grinding, painting - power press and other machines.

3. SAFETY MEASURES 9

Layout design and material handling - Use of electricity - Management of toxic gases and chemicals - Industrial fires and prevention - Road safety - highway and urban safety - Safety of sewage disposal and cleaning - Control of environmental pollution - Managing emergencies in Industries - planning, security and risk assessments, on-site and off site. Control of major industrial hazards.

4. ACCIDENT PREVENTION 9

Human side of safety - personal protective equipment - Causes and cost of accidents. Accident prevention programmes - Specific hazard control strategies - HAZOP - Training and development of employees - First Aid- Fire fighting devices - Accident reporting, investigation.

5. SAFETY, HEALTH, WELFARE & LAWS 9

Safety and health standards - Industrial hygiene - occupational diseases prevention - Welfare facilities - History of legislations related to Safety-pressure vessel act-Indian boiler act - The environmental protection act - Electricity act - Explosive act.

Total: 45

TEXT BOOKS

1. John V. Grimaldi and Rollin H. Simonds, "Safety Management", All India Travellers bookseller, New Delhi-1989.
2. Krishnan N.V., "Safety in Industry", Jaico Publisher House, 1996.

REFERENCES

1. Occupational Safety Manual BHEL.
2. Industrial safety and the law by P.M.C. Nair Publisher's, Trivandrum.
3. Managing emergencies in industries, Loss Prevention of India Ltd., Proceedings, 1999.
4. Safety security and risk management by U.K. Singh & J.M. Dewan, A.P.H. Publishing company, New Delhi, 1996.
5. Singh, U.K. and Dewan, J.M., "Safety, Security and risk management", APH Publishing Company, New Delhi, 1996.

208CCPE05

~~208CCPE05~~ **DESIGN OF MATERIAL HANDLING EQUIPMENTS** 3 0 0 100

(Use of Approved Data Book Is Permitted)

1. MATERIALS HANDLING EQUIPMENT	5
Types, selection and applications	
2. DESIGN OF HOISTS	10
Design of hoisting elements: Welded and roller chains - Hemp and wire ropes - Design of ropes, pulleys, pulley systems, sprockets and drums, Load handling attachments. Design of forged hooks and eye hooks - crane grabs - lifting magnets - Grabbing attachments - Design of arresting gear - Brakes: shoe, band and cone types.	
3. DRIVES OF HOISTING GEAR	10
Hand and power drives - Traveling gear - Rail traveling mechanism - cantilever and monorail cranes - slewing, jib and luffing gear - cogwheel drive - selecting the motor ratings.	
4. CONVEYORS	10
Types - description - design and applications of Belt conveyors, apron conveyors and escalators Pneumatic conveyors, Screw conveyors and vibratory conveyors.	
5. ELEVATORS	10
Bucket elevators: design - loading and bucket arrangements - Cage elevators - shaft way, guides, counter weights, hoisting machine, safety devices - Design of form lift trucks.	

Total 45

TEXT BOOKS

1. Rudenko, N., Materials handling equipment, ELNee Publishers, 1970.
2. Spivakovsy, A.O. and Dyachkov, V.K., LConveying Machines, Volumes I and II, MIR Publishers, 1985.

REFERENCES

1. Alexandrov, M., Materials Handling Equipments, MIR Publishers, 1981.
2. Boltzharol, A., Materials Handling Handbook, The Ronald Press Company, 1958.
3. Tech. P.S.G., "Design Data Book", Kalaikathir Achchagam, Coimbatore, 2003.
4. Lingaiah. K. and Narayana Iyengar, "Machine Design Data Hand Book", Vol. 1 & 2, Suma Publishers, Bangalore, 1983

208 CCPE 04

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METROLOGY AND NON DESTRUCTIVE TESTING

3 0 0 100

1. MEASURING MACHINES 9

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 9

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 9

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. RADIO GRAPHY 9

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 9

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.

Total: 45

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
2. www.sisndt.com
3. www.iuk'tu-harburg.de

308CEPE03

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DATA COMMUNICATION IN CAD / CAM

3 0 0 100

1. DIGITAL COMPUTERS & MICRO PROCESSORS 9

Block diagram - register transfer language - arithmetic, logic and shift micro operations - instruction code - training and control instruction cycle - I/O and interrupt design of basic computer., Machine language - assembly language - assembler.
Registers ALU and Bus Systems - timing and control signals - machine cycle and timing diagram - functional block diagrams of 80 x 86 and modes of operation. Features of Pentium Processors

2. OPERATING SYSTEM & ENVIRONMENTS 9

Types - functions - UNIX & WINDOWS NT - Architecture - Graphical User Interfaces. Compilers - Analysis of the Source program - the phases of a compiler - cousins of the compiler, the grouping of phases - compiler construction tools.

3. COMMUNICATION MODEL 9

Data communication and networking - protocols and architecture - data transmission concepts and terminology - guided transmission media - wireless transmission - data encoding - asynchronous and synchronous communication - base band interface standards RS232C, RS449 interface.

4. COMPUTER NETWORKS 9

Network structure - network architecture - the OSI reference model services - network standardization - example - Managing remote systems in network - network file systems - net working in manufacturing.

5. INTERNET 9

Internet services - Protocols - intranet information services - mail based service - system and network requirements - Internet tools - usenet - e-mail - IRC - www - FTP - Telnet.

Total: 45

References

1. Morris Mano. M., "Computer System Architecture", Prentice Hall of India, 1996.
2. Gaonkar R.S., "Microprocessor Architecture, Programming and Applications of 8085", Penram International, 1997
3. Peterson J.L., Galvin P. and Silberschaz, A., "Operating Systems Concepts", Addison Wesley, 1997.
4. Alfred V. Aho, Ravi Setjhi, Jeffrey D Ullman, "Compilers Principles Techniques and Tools", Addison Wesley, 1986.
5. William Stallings, "Data of Computer Communications" Prentice Hall of India, 1997.
6. Andrew S. Tanenbanum "Computer Networks", Prentice Hall of India 3rd Edition, 1996.
7. Christian Crumlish, "The ABC's of the Internet", BPB Publication, 1996.

308CCPT 07

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COMPUTER AIDED PROCESS PLANNING

3 0 0 100

1. INTRODUCTION 9

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 9

Design Drafting - Dimensioning - Conventional tolerance - Geometric tolerance - 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 9

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 9

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 INTERGRADED PROCESS PLANNING SYSTEMS 9

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

Total: 45

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.
3. Nanua Singh, " Systems Approach to Computer Integrated Design and Manufacturing ", John Wiley & Sons, 1996.
5. Rao, " Computer Aided Manufacturing ", 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>

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TRIBOLOGY IN DESIGN

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1. SURFACES, FRICTION AND WEAR 8

Topography of Surfaces – Surface features – Surface interaction – Theory of Friction – Sliding and Rolling Friction, Friction properties of metallic and non-metallic materials – friction in extreme conditions – wear, types of wear – mechanism of wear – wear resistance materials – surface treatment – Surface modifications – surface coatings.

2. LUBRICATION THEORY 8

Lubricants and their physical properties lubricants standards – Lubrication Regimes Hydrodynamic lubrication – Reynolds Equation, Thermal, inertia and turbulent effects – Elasto hydrodynamic and plasto hydrodynamic and magneto hydrodynamic lubrication – Hydro static lubrication – Gas lubrication.

3. DESIGN OF FLUID FILM BEARINGS 12

Design and performance analysis of thrust and journal bearings – Full, partial, fixed and pivoted journal bearings design – lubricant flow and delivery – power loss, Heat and temperature rotating loads and dynamic loads in journal bearings – special bearings – Hydrostatic Bearing design.

4. ROLLING ELEMENT BEARINGS 10

Geometry and kinematics – Materials and manufacturing processes – contact stresses – Hertzian stress equation – Load divisions – Stresses and deflection – Axial loads and rotational effects, Bearing life capacity and variable loads – ISO standards – Oil films and their effects – Rolling Bearings Failures.

5. TRIBO MEASUREMENT IN INSTRUMENTATION 7

Surface Topography measurements – Electron microscope and friction and wear measurements – Laser method – instrumentation – International standards – bearings performance measurements – bearing vibration measurement.

Total 45

References:

1. Cameron, A. "Basic Lubrication Theory", Ellis Herward Ltd., OK, 1981
2. Hulling, J. (Editor) – "Principles of Tribology", Macmillian – 1984.
3. Williams J.A. "Engineering Tribology", Oxford Univ. Press, 1994.
4. Neale, M.J. "Tribology Hand Book", Butterworth Heinemann, 1995.

Web references:

1. <http://www.csetr.org/link.htm>
2. <http://www.me.psu.edu/research/tribology.html>

308CCPT09

308CCPT09 RAPID PROTOTYPING AND TOOLING

3 0 0 100

(Common for M.E. CAD/CAM, M.E. CAD, M.E. Engineering Design and M.E. Product Design & Development)

UNIT - I

7

Introduction : Need for time compression in product development; Product development – conceptual design – development – detail design – prototype – tooling.

UNIT - II

9

Classification of RP systems, Stereo lithography systems – Principle – process parameters – process details – machine details, Applications.

Direct Metal Laser Sintering (DMLS) system. – Principle – process parameters – process details – machine details, Applications.

UNIT -III

9

Fusion Deposition Modeling – Principle – process parameters – process details – machine details, Applications.

Laminated Object Manufacturing – Principle – process parameters – process details – machine details, Applications.

UNIT - IV

10

Solid Ground Curing – Principle – process parameters – process details – machine details, Applications. 3-Dimensional printers – Principle – process parameters – process details – machine details, Applications, and other concept modelers like thermo jet printers, Sander's model maker, JP system 5, Object Quadra system.

UNIT - V

10

Laser Engineering Net Shaping (LENS), Ballistic Particle Manufacturing (BPM) – Principle. Introduction to rapid tooling – direct and indirect method, software for RP – STL files, Magics, Mimics. Application of Rapid prototyping in Medical field.

Total : 45

TEXT BOOK:

1. Pham,D.T. & Dimov.S.S., Rapid manufacturing, Springer-Verlag, London, 2001.

REFERENCE:

1. Terry wohlers, Wohlers Report 2000, Wohlers Associates, USA, 2000.

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ADVANCED TOOL DESIGN

3 0 0 100

1. TOOL-DESIGN METHODS

5

Introduction – The Design Procedure – Statement of the problem – The Needs Analysis – Research and Ideation – Tentative Design Solutions – The Finished Design – Drafting and Design Techniques in Tooling drawings – Screws and Dowels – Hole location – Jig-boring practice – Installation of Drill Bushings – Punch and Die Manufacture – Electro-discharge machining – Electro-discharge machining for cavity.

2. TOOLING MATERIALS AND HEAT TREATMENT

9

Introduction – Properties of Materials – Ferrous Tooling Materials – Tool steels – Cast Iron – Mild, or low-carbon Steel – Nonmetallic Tooling Materials – Nonferrous Tooling Materials – Metal cutting Tools – Single-point cutting tools – Milling cutters – Drills and Drilling – Reamer classification – Taps – Tap classification- the selection of carbide cutting tools – Determining the insert thickness for carbide tools

3. DESIGN OF DRILL JIGS

9

Introduction – Fixed Gages – Gage Tolerances – The selection of material for Gages – Indicating Gages – Automatic gages – Principles of location – Locating methods and devices – Principles of clamping – Drill jigs – Chip formation in drilling – General considerations in the design of drill jigs – Drill bushings – Methods of construction – Drill jigs and modern manufacturing

4. Design of Fixtures and Dies

14

Introduction – Fixtures and economics – Types of Fixtures – Vise Fixtures – Milling Fixtures – Boring Fixtures – Broaching Fixtures – Lathe Fixtures – Grinding Fixtures – Types of Die construction – Die-design fundamentals – Blanking and Piercing die construction – Pilots – Strippers and pressure pads- Presswork materials – Strip layout – Short-run tooling for Piercing – Bending dies – Forming dies – Drawing operations.

5. TOOL DESIGN FOR NUMERICALLY CONTROLLED MACHINE TOOLS

8

Introduction – The need for numerical control – A basic explanation of numeric control – Numerical control systems in use today – Fixture design for numerically controlled machine tools – Cutting tools for numerical control – Tool holding methods for numerical control – Automatic tool changers and tool positioners – Tool presetting – Introduction – General explanation of the Brown and sharp machine – tooling for Automatic screw machines

Total

45

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~~308PTEU06~~ DESIGN OF HYDRAULIC AND PNEUMATIC SYSTEMS 3 0 0 100

1. OIL HYDRAULIC SYSTEMS AND HYDRAULIC ACTUATORS	5
Hydraulic Power Generators – Selection and specification of pumps, pump characteristics. Linear and Rotary Actuators – selection, specification and characteristics.	
2. CONTROL AND REGULATION ELEMENTS	12
Pressure - direction and flow control valves - relief valves, non-return and safety valves - actuation systems.	
3. HYDRAULIC CIRCUITS	5
Reciprocation, quick return, sequencing, synchronizing circuits - accumulator circuits - industrial circuits - press circuits - hydraulic milling machine - grinding, planning, copying, - forklift, earth mover circuits- design and selection of components - safety and emergency mandrels.	
4. PNEUMATIC SYSTEMS AND CIRCUITS	16
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.	
5. INSTALLATION, MAINTENANCE AND SPECIAL CIRCUITS	7
Pneumatic equipments- selection of components - design calculations – application -fault finding - hydro pneumatic circuits - use of microprocessors for sequencing - PLC, Low cost automation - Robotic circuits.	
	Total 45

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 –Heinemann, 1997.

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1. www.pneumatics.com
2. www.fluidpower.com.tw