

SHRI GURU GOBIND SINGHJI INSTITUTE OF ENGG. & TECH., VISHNUPURI, NANDED

PRODUCTION ENGINEERING DEPARTMENT

M. Tech. (PLM)

Course Outline:

Group of subject	Subject Code	Subject	Teaching Credits				Examination Scheme (Equivalent marks)			
			L	T	P	CREDITS	Mid Term	End Term	Session als/TW	Total
SEMESTER - I										
A	MMP-511A	PLM Fundamentals	3	-	-	3	30	70	-	100
	MMP-512A	New Product Design	3	-	-	3	30	70	-	100
	MMP-513A	Data Management	3	-	-	3	30	70	-	100
B*	MMP-511B to MMP-517B	Students can register for any two from the list of electives provided	3	-	-	3	30	70	-	100
	MMP-511B to MMP-517B		3	-	-	3	30	70	-	100
C	MMP-511C	Programming Lab.	-	-	2	1	-	-	50	50
	MMP-512C	CAD/CAE Lab.	-	-	2	1	-	-	50	50
	MMP-513C	PLM Lab - I	-	-	4	2	-	-	100	100
	MMP-514C	Seminar – I	-	-	2	1	-	-	50	50
		SUB-TOTAL	15	-	10	20	150	350	250	750
SEMESTER - II										
A	MMP-521A	Project Management	3	-	-	3	30	70	-	100
	MMP-522A	Web and Networking Technologies	3	-	-	3	30	70	-	100
	MMP-523A	PLM: Advanced Concepts	3	-	-	3	30	70	-	100
B	MMP-521B to MMP-527B	Students can register for any two from the list of electives provided	3	-	-	3	30	70	-	100
	MMP-521B to MMP-527B		3	-	-	3	30	70	-	100
C	MMP-521C	Web and Networking Technologies Lab.	-	-	2	1	-	-	50	50
	MMP-522C	CAM Lab.	-	-	2	1	-	-	50	50
	MMP-523C	PLM Lab - II	-	-	4	2	-	-	100	100
	MMP-524C	Seminar - II	-	-	2	1	-	-	50	50
		SUB-TOTAL	15	-	10	20	150	350	250	750
Audit Course without examination		Professional Communication	1	-	-	-	-	-	-	-

* For the course MMP-516B, Evaluation scheme shall be as follows: **1.** Theory (03 credits), Mid term (30 marks), End term (70 marks); **2.** Sessionals (01 credit) 50 marks (continuous evaluation)

SEMESTER III AND IV

Sr. No.	Subject	Teaching Credits			
		L	T	P	Credits
MMP-601	Dissertation Part - I	-	-	10	22
	Sub Total	-	-	10	22
MMP-602	Dissertation Part - II	-	-	10	22
	Sub Total	-	-	10	22

ELECTIVES:

SEMESTER - I	
MMP-511B	Computer Aided Design
MMP-512B	Lean Manufacturing
MMP-513B	Finite Element Analysis
MMP-514B	Enterprise Resources Planning
MMP-515B	Mechatronics & Robotics
MMP-516B	Reliability and Life Testing
MMP-517B	Sheet Metals: Modelling and Manufacturing

SEMESTER - II	
MMP-521B	Computer Aided Manufacturing
MMP-522B	Computational Fluid Dynamics
MMP-523B	Supply Chain Management
MMP-524B	Composites: Design & Manufacturing
MMP-525B	Digital Manufacturing
MMP-526B	Design For X
MMP-527B	Green Manufacturing

Programme Structure and Credits

Credits	Sem. I	Sem. II	Sem. III	Sem. IV	Total
Course work					
Core Courses (A group)	09	09			18
Electives (B group)	06	06			12
Lab Courses	04	04			08
Seminar	01	01			02
Project I / II			22	22	44
Total	20	20	22	22	84

MMP-511A: PRODUCT LIFE CYCLE MANAGEMENT: FUNDAMENTALS

Introduction: Background, Overview, Need, Benefits, and Concept of Product Life Cycle, Components / Elements of PLM, Emergence of PLM, Significance of PLM, Customer Involvement.

Product life cycle environment: Product Data and Product Workflow, The Link between Product Data and Product Workflow, Key Management Issues around Product Data and Product Workflow, Company's PLM vision, The PLM Strategy, Principles for PLM strategy, Preparing for the PLM strategy, Developing a PLM strategy, Strategy identification and selection, Change Management for PLM.

Components of PLM: Different phases of product lifecycle and corresponding technologies, Product development processes and methodologies, Foundation technologies and standards (e.g. visualization, collaboration and enterprise application integration), Information authoring tools (e.g., MCAD, ECAD, and technical publishing), Core functions (e.g., data vaults, document and content management, workflow and program management), Functional applications (e.g., configuration management)

Product organizational structure, Human resources in product lifecycle, Methods, techniques, Practices, Methodologies, Processes, System components in lifecycle, slicing and dicing the systems, Interfaces, Information, Standards, Vendors of PLM Systems and Components, Examples of PLM in use.

Text Books:

- **Grieves, Michael**, Product Lifecycle Management, McGraw-Hill, 2006. ISBN 0071452303
- **Antti Saaksvuori, Anselmi Immonen**, Product Life Cycle Management - Springer, 1st Edition (Nov.5, 2003)
- **Stark, John**. Product Lifecycle Management: Paradigm for 21st Century Product Realization, Springer-Verlag, 2004. ISBN 1852338105
- **Kari Ulrich and Steven D. Eppinger**, Product Design & Development, McGraw Hill International Edns, 1999.

References

- Relevant recent technical articles, research papers, key note addresses, etc.
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MMP-512A: NEW PRODUCT DESIGN

Introduction: Types of design, importance of design, design considerations, product life cycle, technology life cycle, benchmarking and mass customisation, stages, objectives, success factors, concurrent approach in NPD

Product Development Process & Methodologies: Integrated Product development process - *Identifying Customer Needs:* Gather raw data from customers, interpret raw data in terms of customer needs, organize the needs into a hierarchy, establish the relative importance of the needs and reflect on the results and the process, *Conceive* – Specification, Concept design: the activities of concept generation, Concept Selection: Overview of methodology, concept screening, and concept scoring, *Design* - Detailed design, Validation and analysis (simulation), Tool design, *Realize* - Plan manufacturing: Factors influencing material and process selection, approaches, tools and software used in selection, Manufacture, Build/Assemble, Test (quality check), *Service* - Sell and Deliver, Use, *Maintain and Support, Dispose*

Product Development Approaches: Bottom-up design, Top-down design, Front-loading design workflow, Design in context, Modular design. Concurrent engineering, partnership with supplier, collaborative and Internet based design, work structuring and team deployment, Product and process systemization, problem, identification and solving methodologies, improving product development solutions

Prototyping: Prototyping basics, principles of prototyping, technologies, planning for prototypes, practical examples

Cases: Select cases from automotive, aerospace, communication, etc. sectors

Text Books:

- **Dieter George E.**, Engineering Design, McGraw Hill Pub. Company, 2000.
- **Ulrich Karl T and Eppinger Steven D.**, Product design and development, McGraw Hill Pub. Company, 1995.
- **Chitale A. K. and Gupta R. C.**, Product Design and Manufacture, Prentice-Hall of India, New Delhi

Reference Book:

- **Bralla, James G.**, Handbook of Product Design for Manufacturing, McGraw Hill Pub. 1986
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MMP-513A: DATA MANAGEMENT

Fundamental Concepts of Database Management: Introduction to DBMS, Entity-Relationship model, Relational model, SQL concepts, Object-Based databases and XML, DBMS architectures, Distributed databases

DBMS packages: Overview/Introduction to DBMS packages like Oracle, MS Access, Visual FoxPro, SQL server, MySQL; Spreadsheets like MS Excel

Introduction to Search: Introduction with a sample search algorithm

Introduction to PDM: Benefits and Terminology, CIM Data, PDM functions, definition and architectures of PDM systems, Engineering data, engineering workflow and PDM acquisition and implementation, Resolving Data Issues, product data interchange, present market constraints, need for collaboration, Internet and developments in client server computing, portal integration

Components of PDM: Components of a typical PDM setup - hardware and document management - creation and viewing of documents - creating parts-version - control of parts and documents

Configuration Management: Base lines, product structure, configuration management

Generic Products And Variants: Products configuration, comparison between sales configuration and products generic, generic product modeling in configuration modeler, use of order generator for variant creation, registering of variants in product register

Projects And Roles: creation of projects and roles - life cycle of a product- life cycle management - automating information flow - work flows - creation of workflow, Templates- life cycle - work now integration.

Change Management: Change issue, change request, change investigation, change proposal, change activity.

Deployment model: Defining deployment methodology, Performance and Scalability

Network Latency etc., various standard technologies available (Akamai Technology etc.),

Text Books:

- **Silberschatz, Korth and Sudarshan**, Database System Concepts, McGraw Hill, 2002
- **Burden Rodger**, PDM: Product Data Management, Resource Pub, 2003. ISBN 0970035225
- **Crnkovic, Ivica; Asklund, Ulf; & Dahlqvist, Annita Persson**, Implementing and Integrating Product Data Management and Software Configuration Management, Artech House Publishers, 2003. ISBN 1580534988
- **Grieves, Michael**, Product Lifecycle Management, McGraw-Hill, 2006. ISBN 0071452303
- **Antti Saaksvuori, Anselmi Immonen**, Product Life Cycle Management - Springer, 1st Edition (Nov.5, 2003)
- Software documentation of Oracle, MS Access, Visual FoxPro, SQL server, MySQL, MS Excel

MMP 511B: COMPUTER AIDED DESIGN (CAD)

Product design process: Importance of design, design process, technological innovation and the design process, Team behavior and tools; Embodiment design: Product architecture, configuration of design, parametric design, Industrial design, Human factors design, Design for X (DFX)

CAD – Introduction, Role of CAD, CAD system architecture, Hardware and software for CAD, Software modules, ICG, Graphics Software, Ground rules for design of GS, functions of GS, modeling and simulation, Solid modeling methods

An overview of modeling software like UG/NX, Solid Works, Autodesk Inventor, Professional, AutoCAD, PRO/E, CATIA: Capabilities, Modules, Coordinate systems, Sketching tools, solid modeling tools, surface modeling tools, expression/parameters toolbox, data exchange tools, API and customization facilities

Geometric transformations: 2D and 3D; transformations of geometric models like translation, scaling, rotation, reflection, shear; homogeneous representations, concatenated representation; Orthographic projections

CAD/CAM Data exchange and data storage: Introduction, graphics and computing standards, data exchange standards like IGES, STEP, Model storage - Data structures - Data base considerations - Object oriented representations - Organizing data for CIM applications - Design information system

Mathematical representations of solids: Fundamentals, Solid models, Classification of methods of representations, half spaces, boundary representation, CSG, sweep representations, Octree representations, primitive instancing, cell decomposition, spatial occupancy enumeration

Mathematical representations of curves and surfaces: Curve representation, parametric representation of analytic and synthetic curves; Surface models, Surface representations, parametric representation of analytic and synthetic surfaces

Assembly modeling: Representation, mating conditions, representation schemes, generation of assembling sequences Visualization, Multi CAD system (JT etc.), how to manage non-geometric data for eg. Visualization data, light weight representations techniques such as tessellation / voxelization their motivation, how visual representation can be obtained from tessellated, voxelized data, reverse engineering, evolution

AI approaches and applications in CAD, Knowledge Based Engineering, OpenGL, Introduction to Advanced visualization topics in CAD like Modern representation schemes like FBM, PM, Feature recognition, Design by features, Tolerance modeling, System customization and design automation, Open Source CAD like Open CASCADE

Text Books

- **Chris McMahon and Jimmie Browne**, CAD/CAM – Principle Practice and Manufacturing Management, Addison Wesley England, Second Edition, 2000.
- **Ibrahim Zeid**, CAD/CAM theory and Practice, Tata McGraw Hill Publishing Co. Ltd., New Delhi, 1992.
- **Dieter George**, Engineering Design – A materials and processing approach, McGraw Hill Publishers, 2000

- **Ibrahim Zeid**, Matering CAD/CAM, Tata McGraw Hill Publishing Co. Ltd., New Delhi.
- **Rogers, D.F. and Adams, A.**, Mathematical Elements for Computer Graphics, McGraw Hill Inc, NY, 1989
- **P.Radhakrishnan, S.Subramanayan and V.Raju**, CAD/CAM/CIM, New Age International (P) Ltd., New Delhi.
- **Groover M.P. and Zimmers E. W.**, CAD/CAM: Computer Aided Design and Manufacturing, Prentice Hall International, New Delhi, 1992.
- **Dr. Sadhu Singh**, Computer Aided Design and Manufacturing, Khanna Publishers, New Delhi, Second Edition, 2000.
- **Software Documentation, tutorials, manuals of following software,**
 - UG/NX
 - Solid Works
 - CATIA
 - Autodesk Inventor Professional
 - AutoCAD
 - Open CASCADE
 - ANSYS Design modeler
 - Pro/E

MMP 512B: LEAN MANUFACTURING SYSTEMS

Just In Time Production System: JIT Logic -Pull system, Japanese approach to production elimination of waste, JIT implementation requirements, JIT application for job shops

Kanban System: Kanban rules supplier Kanban and sequence schedule used by supplier, Monthly information & daily information, Later replenish system by Kanban sequenced withdrawal P system by sequence schedule table -problems & counter measures in applying Kanban system to subcontractors -Supplier Kanban circulation in the paternal manufacturer - structure of supplier Kanban sorting office.

The Rise & Fall of Mass Production: Mass production, work force, organization, tools, product –logical limits of mass production, Sloan as a necessary compliment to Ford

The Rise Of Lean Production: Birthplace, concrete example, company as community, Final assembly plant, product development and engineering. Changing customer demand, dealing with the customer, future of lean production.

Shortening Of Production Lead Times: Reduction of setup times, practical procedures for reducing setup time. Standardization of operations, Machine layout, multi function workers and job rotation, Improvement activities to reduce work force and increase worker morale, foundation for improvements.

Elements of Lean Production

Managing Lean Enterprise: Finance, Career ladders, geographic spread and advantages of global enterprise.

An action plan: Getting started, Creating an organization to channel your streams, install business system to encourage lean thinking, the inevitable results of 5-year commitment.

Text Books

- **Chasel Aquilino**, “Productions and Operations Management”
- **Yasuhiro Monden**, “Toyoto Production System -An integrated approach to Just in Time”, Engineering and Management Press, Institute of Industrial Engineers, Norcross Georgia.
- **James P Womack, Daniel T Jones, and Daniel Roos**, “The Machine that changed the World. The Story of Lean Production”, Harper Perennial edition, 1991.
- **James Womack**, “Lean Thinking”.
- **Richard Schourberger**, “Japanese Manufacturing Techniques. The Nine Hidden Lessons by simplicity”.
- **James Bossert**, “Quality Function Development”, ASQC Press 1991.
- **Launshy and Weese**, “Straight talk on design of experiments”.

MMP513B: FINITE ELEMENT ANALYSIS

Introduction to Finite Element Method: Basic Concept, Historical Background, Engineering applications, general Description, comparison with other methods.

Finite Element Modeling: Introduction, Mesh Generation, mesh requirements, Semi-Automatic Methods, Node-based approach, Region based approach, Solid-modeling-based methods. Fully Automatic Methods- Element-based approach, Application. Modeling Hints - utilizing symmetry – symmetric and anti symmetric B.C, proper and effective usage of different types of elements, warping limit, corner angle, aspect ratio, Acceptable and Unacceptable Distortion, Mesh Refinements using Isoparametric Finite Elements, Meshing in high gradient areas, Transition Regions. Sub modeling Concept, Interface of CAD and FEA software packages.

Finite Element Techniques:

Applications to solid and structural mechanics problems: External and internal equilibrium equations, one-dimensional stress-strain relations, plane stress and strain problems, axis symmetric and three dimensional stress strain problems, strain displacement relations, boundary conditions compatibility equations, analysis of trusses, frames and solid of revolution, computer programs.

Applications to heat transfer problems: Variational approach, Galerkin approach, one dimensional and two dimensional steady state problems for conduction, convection and radiation, transient problems.

Parameters affecting Accuracy of the FEA results: How to validate and check accuracy of FEA results? Computational accuracy: strain energy norm, residuals, Reaction forces and moments; convergence test, Average and unaverage stress difference. Correlation with actual testing: strain gauging-stress comparison; natural frequency comparison; Dynamic response comparison, temperature and pressure distribution comparison.

Text Books:

- **R.D. Cook, D. S. Malku**, Concepts and applications of Finite Element Analysis, John Wiley and Sons, New York, Second Edition, 1981
 - **J. N. Reddy**, An introduction to Finite Element Analysis, Tata McGraw- Hill Pub. Co., 2005.
 - **T. J. R. Hughes**, The Finite Element Method: Linear Static and Dynamic Finite Element Analysis, Dover Publications, 2000
 - **Chandrupatala and Belegundu**, Introduction to Finite Elements in Engineering. Prentice Hall India, 2003
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MMP514B: ENTERPRISE RESOURCES PLANNING

Introduction to ERP: Introduction, Evolution of ERP, Reasons for growth of ERP, Advantages / disadvantages of ERP, Evaluation of ERP, Various Modules in ERP

Modules in ERP: Finance and Controlling, Sales and Distribution, Materials Management, Production Planning and Control, Quality Management, Planet Maintenance, Human Resource

Business Processes: Order To Cash, Procure To Pay, Plan To Produce, Make To Stock, Make To Order and Assemble To Order, Difference in Discrete and Process industries

Manufacturing Process Knowledge: Auto Industry, Hi Tech, FMCG, Pharma and Chemical

ERP Projects: Project types, Implementation methodology, Various steps in the project Implementation, Project Preparation, Business Blueprinting, As Is – To Be Study, Gap Analysis, Realization, Final Preparation, Go Live and Support, User Training, Issues during implementation

ERP and Related technologies: Business Process Re – engineering, MIS, Executive Information System, Decision Support System

ERP Market: ERP packages like SAP, BAAN, Oracle Apps, JD Edwards, Comparison Study, Evaluation and Selection

Future Directions in ERP: Current trends in ERP, Changes in the ERP Implementations, Faster implementation methodologies, Web enabling

Integration of ERP with SCM, SRM, CRM and PLM., system architecture, landscape and licensing

Text Books

- **V.K. Garg & N.K. Venkitakrishnan**, ERP Ware: ERP Implementation framework
- **V.K. Garg & N.K. Venkitakrishnan**, ERP Concepts and Planning
- **Alexis Leon**, Enterprise Resource Planning

References

- APIC's material on ERP
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MMP515B: MECHATRONICS AND ROBOTICS

Mechatronics: Introduction to Mechatronic system, evolution, scope and components of Mechatronics systems, Mechatronics in product and measurement system, control system and modes of control, traditional design and Mechatronic design, Introduction to Sensors, Signal conditioning and Actuators

Programmable Logic Controller: Review of logic gates, basic structure, features, input/output processing, programming, functional block diagram (FBD), ladder diagram, logic functions, latching, sequencing, jumps, internal relays, counters, shift registers, master and jump control, data handling, data movement, data comparison, arithmetic operations, code conversion, analog input and output

Microcontrollers: Comparison between microprocessor and microcontroller, organization of microcontroller system, architecture of MCS 51 controller, pin diagram of 8051, addressing modes, programming of 8051, interfacing input and output devices, interfacing D/A converters and A/D converters,

Real-Time Interfacing: Introduction, Elements of Data Acquisition and Control System, Overview of I/O Process, Installation of the I/O Card and Software, Installation of the application, Software, Examples, Over framing

Robotics: Robot Definition, Classification of Robots, Robot System components, Functions of Robot System, Specification of Robot System, Robot Drives and Power transmission systems, Remote Centered Compliance devices.

Robotic Sensory Devices, Non optical Position sensors, Optical position sensors, Velocity sensors, Accelerometers, Proximity sensors, Touch and Slip Sensors, Force and Torque sensors – Robot vision system

Robot cell layouts – multiple Robots and machine interface, consideration in work cell design, interlocks, error detection and recovery, Robot cycle time analysis, simulation of Robot work cells.

Applications of robots in material transfer, machine loading and unloading, welding, assembly and inspection, safety, training, maintenance and quality aspects, Economics and social aspects of robotics

Text Books:

- **W. Bolton**, Mechatronics, 3/e, Pearson Education
- **Devdas Shetty, Richard A. Kolk**, Mechatronics System Design, Thomson
- **Richard D.Klafter**, Thomas A.Chmielewski and Michael Negin Robotic Engineering – An Integrated Approach, Prentice Hall of India Pvt Ltd, 2002
- **Shimon Y.Nof**, Hand Book of Robotics, John Wiley sons, 1985.

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MMP516B: RELIABILITY AND LIFE TESTING

Basic concepts in Reliability: Risk and Reliability, Bath tub curve, Failure Mechanism of mechanical components: causes, modes, function of mechanical elements, failure theories.

Component Reliability: Failure data analysis, reliability function, hazard rate, failure rate, and their relationship, MTTF, mean failure rate, MTBF.

System Reliability: Series, parallel, mixed configuration, r-out of-n structure, solving complex systems, reliability logic diagrams (RLD). *Techniques of Reliability Estimation:* Fault Tree analysis, tie sets and cut-sets, Boolean algebra.

System Reliability Improvement: use of better components, simplification, derating, redundancy, working environment control, maintenance, etc. *Redundancy Techniques:* Introduction, component vs unit redundancy, weakest link technique, mixed redundancy, standby redundancy, redundancy optimization, double failure and redundancy.

Case Application of complex systems: Marine power plant, computer system, Nuclear power plant, combats aircraft, etc.

Reliability Testing: Introduction, objectives, assumption, different types of test. *Life testing in practice:* Methodology, problems and difficulties. Economics of Reliability engineering.

Acetated Life Cycle Testing: Intro, basic concepts, data qualification. Accusations faster, stress combination methods, limitations, step stress method for AST, various AST models, recent development recommended approach. Highly accelerated life testing (HALT), HASS

Self Learning Component Through Sessionals: Case application, assignments, subject paper/project, presentation etc.

Text Books:

- **Srinath LS**, Mechanical Reliability, Affiliated East-West Press Pvt. Ltd, New Delhi.
- **Srinath LS**, Reliability Engineering Third Ed., Affiliated East-West Press Pvt. Ltd, New Delhi.
- **V.N.A. Naikan**, Reliability Engineering and Life Testing, PHI Learning Pvt. Ltd. New Delhi.
- **E. Balagurusamy**, Reliability Engineering, TMH, New Delhi

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MMP517B: SHEET METAL: MODELING AND MANUFACTURING

Sheet Metal Modeling: Sheet Metal Methods, Stages in the Process, Designing with Sheet Metal Features, Miter & Edge Flanges, Bend Angles, Adding a Tab, Flat Pattern, Cuts, Sheet Metal Parts in Drawings, Sheet Metal Forming Tools, Edge Flanges and Closed Corners, Hems, Curved Edge Flanges, Designing in Flat, Existing Rounds, Using Symmetry, Manual Relief Cut, Break Corner, Jog Feature, Lofted Bends, Sheet Metal Topics, Recognize Bends Method, Opening IGES Files, Using the Rip Feature, Adding Bends in Place of Sharp, Corners, Sheet Metal Features, Making Changes, Adding a Welded Corner, Sheet Metal from Shelled Parts, Unrolling Cones and Cylinders, Process Plans,

Plastic Deformation in Metals: The flow curve, true stress, true strain, yielding criteria for ductile metals, plastic stress – strain relations, strain hardening coefficient, normal anisotropy coefficient, formability evaluations, drawability tester, high strength, low alloy steels developed for formability: HSLA steels, Dual phase steels, DQAK steels, CHR-X steels, two- dimensional

plastic, flow – slip line field theory, Mechanics of metal working, Temperature in metal working, strain rate effects, metallurgical structures, Friction and lubrication, lubricants for hot and cold working, Deformation zone geometry, workability and residual stresses

Forming Equipments: Forming Equipment - types and press construction, Principle of working of Mechanical, Hydraulic and Pneumatic press. Press control system in forging equipments, Presses for hydro forming, selection of presses

Sheet Metal forming: Press tool operations - classification based on type of stresses, Shearing operations (blanking and piercing), and effect of clearance, Calculation of punching force, Trimming, Shaving, Nibbling and Notching operations, Drawing and Deep drawing, redrawing, limiting draw ratio, forming limit criteria draw die design. Bending, spring back in bending. Spinning, stretch forming, Embossing, Coining, Rubber forming. Defects in formed parts. Sheet Metal Forming Dies – progressive die, compound and combination die. Die Construction, Center of pressure calculation, Stock strip layout, Strip development

Text Books:

- **Dieter G. E. Bacon David**, Mechanical metallurgy, McGraw Hill, ISBN-0-07-100406-8
 - **Grobh Schuler**, Metal forming handbook, Springer Verlag Berlin, Heidelberg, 1998, ISBN-3-540-61185-1
 - **Cyril Donaldson, George H. Locain, V. C. goold**, Tool Design, Tata McGraw Hill, ISBN-0-07-099274-6
 - **Frank w. Wilson**, Fundamentals of tool design, ASTME, prentice Hall of India, New Delhi ISBN-0-87692-058-10
 - **Roy A. Lindberg**, Processes and materials of manufacturing, Prentice Hall of India, New Delhi, ISBN-81-203-0663-5
 - **Prakash H. Joshi**, Press tools: design and construction, Wheeler Publishing, New Delhi, ISBN-81-85814-46-5
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MMP511C: PROGRAMMING LAB.

Study of Programming in following languages:

C++ using following IDEs,
Turbo C++, Dev C++, Visual C++ (Visual Studio 2008)

JAVA using JDK
OOP using Java, Inheritance, inner classes, Interfaces
AWT (Abstract Windowing Toolkit)/Swing: Applets, Applications and event handling
Filing and printing documents
Networking with Java
Java an XML, Images and animations, talking to databases, JDBC

Study of DBMS

ORACLE
Installation and overview of Oracle
PL/SQL
Table definition/creation and modification
Using tables
Insertion and modification of data, manipulating data
Sorting data
Displaying data from multiple tables
Sub-queries
Constraints
Creating views
Controlling user access
Triggers

Text Books / Documentation:

1. **Holzner Steven**, Java 2 Programming Black Book, Dreamtech Publishers
 2. **Savitch**, Java Programming
 3. **Yashwant Kanetkar**, Visual C++ Programming, BPB Publications, 1998
 4. **Hervert Schildt**, Oop with C++
 5. Oracle documentation,
 - a. Oracle 9i Introduction to SQL Part I and II
 - b. Performance tuning Vol. I and II
 - c. Oracle Application development guide and other necessary documents
 6. User and Programmers guides and related documentation of Visual FoxPro, MS Access, etc
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MMP512C: CAD/CAE LAB.

CAD:

Study of at least one CAD software in each of the following category,

High-End CAD like UG/NX, CATIA, Pro/E

Middle-range CAD like Solid Edge, AIP, Solid Edge

Low-end CAD like AutoCAD, Turbo CAD, AutoCAD LT

Assembly modeling (for any 2 assemblies or sub-assemblies) using top down and bottom-up approaches inclusive of sketching, parts modeling (using solid and surface modeling/styling toolboxes), drafting (parts and assemblies)

Part families and design table creation using spreadsheet interface

CAD File/data exchange amongst the various CAD software and software for CMM, CAE, CNC, CAM

Customization/Program development for parts modeling and drafting using API and other development tools

FEA: Using any FEA software packages solve 2 problems each on structural mechanics and heat transfer, Introduction to nonlinear analysis

Interface: Data Transfer between CAD and FEA packages, Geometry clean up

MMP513C: PLM LAB – I

Introduction, Installation & maintenance of following software:

Oracle / SQL Server / DB2

PLM Server

CAD Software

MS Office

Rich client

Web client

Application server

Software/ Hardware/ Network issues resolutions, Understanding PLM Implementation phases like Requirement Gathering, Gap analysis, Software Specification Document, System building, CRP

Product Development – Basic Concept, Product Development II – Phases, Product Development and Information System, Product Data Management (PDM), PDM Basic Functions, PDM Function - Product Structure Management, PDM Function - Electronic Vault Management, PDM Function - Workflow Management, PDM Function - Project Management, PDM Function - Search Management, Product Lifecycle Management (PLM) Concept, PLM Special Functions, PLM Special Functions, Industry Cases, Project Presentation

MMP514C: SEMINAR-I

The seminar shall consist of study of a particular topic based on 4-6 research papers or case study of 1/2 industries. The internal marks shall be awarded as the basis of performance of the individual student during his/her seminar presentation. Each student is also required to submit a report based on above study in the prescribed format.

MMP521A: PROJECT MANAGEMENT

Introduction To PM: Projects in Contemporary Organization, Project Life Cycle

Project Initiation: Strategic Management, Project Selection & Evaluation, Selection Criteria & Models, Risk Management, Portfolio Process, Project Proposals, Project manager: Demands on Project manager, Selecting the Project Manager, Multicultural Communication, Project Organization: Organizational Concepts in PM, Selecting an Organizational Form, Project Planning: Systems integration, WBS & Responsibility Charts, Interface Coordination, Conflict and Negotiation in PM: Nature of Negotiation, Conflict and Project Life Cycle

Project Implementation: Budgeting and Cost Estimation: Estimating Project Budgets, Improving Cost Estimation Process, Scheduling: Background, Network Techniques: PERT & CPM, Risk Analysis & Crystal Ball Simulation, Resource Allocation: CPM & Crashing a Project, Resource Allocation, Resource Loading & Levelling, Constrained Resource Scheduling, Multi-project Scheduling & Resource Allocation, Goldratt's Critical Chain, Monitoring & Information System, Planning-Monitoring-Controlling

Information Needs & Reporting Process, Earned Value Analysis, Computerized PMIS, Project Control: Need for Project Control, Three Types of Control Processes, Design of Control Systems, Control of Creative Activities, Control of Change & Scope, Creep

Project Termination: Project Auditing: System Goals & Project Audit, Audit Report, Project Audit Life Cycle, Project Termination, Varieties of Project Termination, Termination Process, Final Report, A Project History

Text Books

- **P. Gopalakrishnan and V. E. Rama Moorthy**, Project Management, Macmillan India Ltd., New Delhi, 1993.
 - **Prasanna Chandra**, Projects: Preparation, Appraisal, Budgeting and Implementation, Tata McGraw Hill Publishing Company Ltd., New Delhi, 1980.
 - **B. B. Goel**, Project Management: Principles and Techniques, Deep & Deep Publications, New Delhi, 1986.
 - **UNIDO Series** on Project Management.
-

MMP522A: WEB AND NETWORKING TECHNOLOGIES

Web: History of Web application, W3C, Introduction to various web building technologies.

Mark up languages: Use of markup languages in building web applications, Hypertext Markup language (HTML), (Extensible mark-up Language) XML,

XML Parsers: What is parsing, Types of parsers, benefits and limitations of each parser.

RMI and networking: Introduction to Remote Method Invocation (RMI), Importance of RMI in web applications

J2EE technologies:

JSP- What is JSP, JSP architecture, Session in JSP, Cookies and use of cookies. Servlet- Introduction to Servlet technology, web container, Methods of Servlet, Lifecycle of a servlet, advantages of servlet, HTTP session listener and filters in servlet.

EJB3- Introduction to Application server, Features of enterprise beans, benefits of EJB, Annotations, Introduction to POJO, stateless and stateful session beans.

Ajax- Introduction to framework, rule of ajax in enhancing user experience, ajax examples.

Distributed Computing Concepts of Client-Server Architecture (2-Tier, 4-Tier, n-Tier), Design aspects, Technologies (.NET, J2EE)

Security: Computer network security, data security, issues, techniques involved, known practices, multisite configurations, issues,

Introduction to Hibernate and JSF

Text Books:

- David Hunter et al, 'Beginning XML'
 - XML - O'Reilly Media
 - Jennifer Niederst, Learning Web Design 2nd Edition
 - Elizabeth Castro, HTML for the World Wide Web
 - Rod Johnson, Expert One-on-One J2EE Design and Development
-

MMP523A: PLM: ADVANCED CONCEPTS

Global Multi-site, Global Change Management System (GTS), Legacy System Integration, Legacy Data Transfer, Security in PLM (SSO/SSL etc),

Product master management (managing the deployment of the finished design into the production environment), product architecture (Functional architecture, Physical architecture etc), understanding business object, CAD-BOM alignment, security services, PLM localization, Business modeling, classification structure, PLM System Architecture (2tier/3tier/4tier etc)

Managing Changes and Workflows, Classifying Data, Managing Documents, Reports, Requirements, and Schedules, Sharing Data, Managing Product Structures, Managing Manufacturing Data, Managing Mechatronics Data, Visualizing Products, Managing CAE Data, Repeatable Digital Validation, Managing Quality Data, Managing Maintenance, Repair, and Overhaul Data

Product Data: Data objects to represent product data, such as parts, assemblies, processes, product changes, requirements, and specifications, Simple parts (with JT /with CAD /with CAD+JT/ with CAD + drawing / with CAD + JT + drawing + other documents), Simple assembly, multilevel assembly, Hybrid assembly, concurrency in data transfer (replica transfer/delta transfer/re-export), collision

Concepts of Product Structure management such as Configurations,

Multi CAD Integrations, issues involved, data management of heterogeneous CAD systems, management of product data interfaces, GD&T, annotations, manufacturing notes

Integration of CAM with PLM

Text Books:

- **Grieves, Michael**, Product Lifecycle Management, McGraw-Hill, 2006. ISBN 0071452303
- **Antti Saaksvuori, Anselmi Immonen**, Product Life Cycle Management - Springer, 1st Edition (Nov.5, 2003)

- **Stark, John.** Product Lifecycle Management: Paradigm for 21st Century Product Realization, Springer-Verlag, 2004. ISBN 1852338105
- **Kari Ulrich and Steven D. Eppinger,** Product Design & Development, McGraw Hill International Edns, 1999.

References

- Relevant recent technical articles, research papers, key note addresses, etc.

MMP521B: COMPUTER AIDED MANUFACTURING

NC/CNC: Scope and applications, NC in CAM, Principal types of CNC machine tools and their construction features, tooling for CNC, ISO designation for tooling, CNC operating system: FANUC, SINUMERIK, LINUMERIK, Programming for CNC machining – coordinate systems – manual part programming – computer assisted part programming – CNC part programming with CAD system.

Material handling in CAM environment – types – AGVS – AS/RS – Swarf handling and disposal of wastes – single and mixed mode assembly lines – quantitative analysis of assembly systems.

Computer Aided Production Planning and Control: Process Planning: Variant and Generative systems, Aggregate production planning and master production schedule, MRP, MRP II, Capacity planning, Shop Floor Control

Rapid prototyping: Need for rapid prototyping, Basic principles and advantages of RP, General features and classifications of different RP techniques with examples, Introduction to three representative RP techniques: Fusion Deposition Modeling, Laminated Object Manufacturing and Stereo-lithography.

Introduction to Computer Aided Inspection: Coordinate Measuring Machine and its operations

Text Books

- **Mikell P.Groover,** Automation , Production Systems and Computer Integrated Manufacturing, Second edition, Prentice Hall of India, 2002
- **S.Kant Vajpayee,** Principles of Computer Integrated Manufacturing, Prentice Hall of India, 1999 David Bed worth, Computer Integrated Design and Manufacturing, TMH, 1998
- **Ranky, Paul.G.,** Computer Integrated Manufacturing, Prentice Hall International, 1986

MMP522B: COMPUTATIONAL FLUID DYNAMICS

Introduction: CFD as the third dimension of fluid mechanics. Numerical Discretization methods such as Finite Difference, FEM and FVM, Why FVM as preferred method in CFD.

Basic Equations of Fluid Dynamics: Potential flow, Nonlinear Potential flow, Inviscid flows and viscous flows, Navier Stokes Equations, Primitive variable vs. conservation form, Dimensional form vs. Non dimensional form

Numerical methods for Convection - Diffusion equations: Upwinding and central difference schemes, Stability condition in terms of Courant number

Numerical Methods for Inviscid Flows: Characteristic form of equations, Flux difference splitting, Application to 2-D flows such as flow through a nozzle

Numerical methods for Incompressible flows: The continuity equation divergence constraint. Poisson equation for pressure, Schemes such as SIMPLE due to Patankar and Spalding

Text Books:

- **Veersteeg and Malalasekara, CFD: The Finite Volume Method, Prentice Hall, 1996**
- **Anderson, Tannehill and Pletcher,** Computational Fluid Mechanics and Heat Transfer, Hemisphere Publishers, 1984.
- **C A J Fletcher,** Computational Methods for Fluid dynamics: Vol 1 and 2.Springer Verlag, 1987
- **C. Hirsch,** Numerical Computation of Internal and External Flows Vol.1 and 2.
- **D C Wilcox,** Turbulence Modeling for CFD, DCW Industries.

MMP523B: SUPPLY CHAIN MANAGEMENT

Logistics and Competitive Strategy: Competitive advantage – gaining competitive advantage through logistics – mission of logistics management – supply chain and competitive performance – changing logistics environment, supply chain management and the PLM ecosystem.

Customer Service Dimension: marketing and logistics interface – customer service and customer retention – service driven logistics systems – setting customer service priorities – setting service standards.

Measuring Logistics Cost and Performance: concept of total cost analysis – principles of logistics costing – logistics and the bottom line – logistics and shareholder value – customer profitability analysis – direct product profitability – cost drivers and activity-based costing.

Benchmarking the Supply Chain: benchmarking the logistics process – mapping supply chain processes – supplier and distribution benchmarking – setting benchmarking priorities – identifying logistics performance indicators.

Managing the global pipeline: trend towards globalization in the supply chain – challenge of global logistics - organizing for global logistics.

Strategic Lead-Time Management: time based competition – concept of lead-time – logistics pipeline management – logistics value engineering – lead-time gap.

Just In Time and Quick Response Logistics – Japanese philosophy – implications for logistics – quick response logistics – vendor managed inventory – logistics information systems – logistics systems dynamics – production strategies for quick response.

Managing the Supply Chain: creating logistics vision – problems with conventional organizations – developing logistics organizations - logistics as a vehicle for change – need for integration – managing supply chain as a network – process integration and ECR – co-makship and logistics partnerships – supplier development.

Role of Information Systems and Technology in SCM: importance of information in an integrated SCM environment – inter organisational information systems (IOIS) – information requirements determination for a supply chain IOIS – information and technology applications of SCM.

Developing and Maintaining Supply Chain Relationships: conceptual model of alliance development – developing a trusting relationship with partners in supply chain – resolving conflicts in supply chain relationship.

Cases in SCM: Future Challenges in SCM: greening of supply chain – design for SCM – intelligent information systems.

Text Books

- **Martin Christopher**, - Logistics and Supply Chain Management – Strategies for reducing cost and improving service, Pitman Publishing, II Edition, 1998.
 - **Robert B Handfield and Ernest L Nicholas Jr.**, Introduction to Supply Chain Management, Prentice Hall, NJ, 1999.
 - **Donald J Bowersox and David J Closs**, Logistical Management, Tata McGraw Hill, New Delhi, 2000.
 - **David Taylor and David Brunt**, Manufacturing Operations and Supply Chain Management, Thomson Learning, 2001.
 - **David Simchi and Levi**, Designing and Managing the Supply Chain, McGraw Hill, 2000.
 - **J B Ayers**, Handbook of Supply Chain Management, St. Lencie Press, 2000.
 - **B S Sahay**, Supply Chain Management for Global Competitiveness, Macmillan India Ltd., New Delhi, 2000.
 - **P B Scharj and TS Lansen**, Managing the Global Supply Chain, Viva Books, New Delhi, 2000.
-

MMP-524B: COMPOSITE MATERIALS TECHNOLOGY

Definition – Need – General Characteristics , Matrix materials – Polymer, Metal, Carbon and Ceramic Matrices, Reinforcement – Types – fibers, whiskers and particles, Reinforcement materials, Selection, advantages and limitations.

Polymer Matrix Composites – Matrix Resins – Thermosetting resins, Thermoplastic resins, Polyacryl ethers (PAE), Thermoplastic Polyimides (TPI), Polyacrylene Sulfide, Molecularly ordered liquid Crystals (MOLC), Polyblends Alloys, Fibers and Laminated Composites.

Metal Matrix Composites – Matrix selection, Reinforcement and reinforcement selection, Matrix reinforcement interface, Interaction zone, Interface bond strength.

Polymer Matrix Production Methods – Bag Moulding, Compression Moulding, Pultrusion, Filament Winding, Metal Matrix Composites - Fabrication methods – Solid State Techniques and Liquid State Techniques

Micro mechanics and macro mechanics of composites, monotonic strength and fracture, Fatigue and Creep, Applications of composites. Composites Processing.

Text Books

- **Krishan K.Chawla**: Composite Materials : Science and Engineering, Springer, 2001.
 - **F.L.Mathews and R.D.Rawlings**: Composite Materials - Engineering and Science, RC Press, 2002.
 - **Mallic P.K.**: Fiber - Reinforced Composites: Materials, Manufacturing and Design, Marcel Dekker Inc, 1993.
 - **Sanjay K. Mazumdar**: Composites Manufacturing: Materials, Product and Process Engineering, CRC Press, 2002.
 - **R. M. Jones**, Mechanics of Composite Materials, Taylor and Francis, Philadelphia, 1984.
-

MMP525B: DIGITAL MANUFACTURING

Introduction to Digital Manufacturing: A Brief History of Manufacturing, Digital Manufacturing Today, Digital Design, Digital Materials, Digital Fabrication, Digital Products, Technology Development, Applications Development, People and Business, The Digital Economy, Transition from Industrial Manufacturing

Process simulation and validation: Assembly and component manufacturing, process simulation and validation, Ergonomic/human simulation, Robotic simulation and OLP

Plant design, simulation & optimisation: Station / work-cell layout design, Throughput simulation, Discrete event simulation, Optimisation of material flow and logistic

Manufacturing process simulation solution customisation: Functionality enhancements as extensions of OOTB software solution, Reports customisation, User interface customisation

Special Topics: Informatics platform for designing and deploying e-manufacturing systems, framework for integrated design of Mechatronic systems, Collaborative supplier integration for product design and development. Reconfigurable manufacturing systems design, Virtual Reality based platform for collaborative product review and customisation, Managing collaborative process planning activities through extended enterprise, rapid product development, desktop assembly factories, Information sharing in digital manufacturing based on STEP and XML

Text Books:

- Wang, Lihui; Nee, Andrew Y.C. (Eds.) Collaborative Design and Planning for Digital Manufacturing, Springer, 2009
-

MMP526B: DESIGN FOR 'X'

Introduction: Need, evolution, fundamentals and usages of DFX, Performance characteristics and tool kits for DFX, Development and Implementation of DFX tools.

Design for Manufacturing, Assembly and Disassembly: Principles, approaches, Product and component DFMA, The B & d Experience, Evaluations for DFMA.

Design for assorted technical requirements/processes: Material storage and distribution, Dimensional control, Heat treatment, Coating Casting, Plastic processes like wise.

Design for Life Cycle: Approaches to product development, Inspectability, Serviceability.

Design for Reliability, Quality: Approaches, QFD, Evaluations and Procedures.

Design for competitiveness: Modularity, Technical Merit, Optimization of Product Life cycle and allied.

Text Books:

- Design for X: Concurrent Engineering Approach, Edited by G. Q. Haung, Chapman & Hall, 1996.
 - Industrial Assembly, S. Y. Nof. W. E. Wilhelm and H. J. Warnecke, Chapman & Hall, 1996
 - Assembly Automation and Product Design, Geoffrey Boothroyd, Marcel Dekker, Inc,
 - Design For Manufacturing: A Structured Approach, Corrado Poli, Butterworth Heinemann
 - Process selection from Design to Manufacturing, Swift and Booker, Butterworth Heinemann
 - Design For Manufacturability Handbook, James Barilla, McGraw Hill
 - Design For Manufacturing and Concurrent Engineering, David M. Anderson, CIM press, 2004
-

MMP527B: GREEN MANUFACTURING

Introduction: Environmental Impacts & Its Assessment, Industrial Ecology & Its Principles, Green Manufacturing By Design, Life Cycle Assessment, Hazardous Substances & Wastes Treatment Processes, ISO 14000, Standards and definitions, Accreditation procedures; Environmentally Benign Manufacturing, supply Chain issues, environmental concerns with manufacturing processes, Tangible versus intangible benefits of green manufacturing

Design for the Environment: Life Cycle Assessment, DFE principles, government partnerships

Organization, Management and Improvement of Manufacturing Systems: Leadership and management systems, organizational behaviour, problem solving methods, implementation considerations

Manufacturing System Evaluation: Principles of auditing, assessment techniques

Air and Water Quality Issues: Essential chemistry principles, treatment techniques, prevention methods

Environmentally Conscious Processes: Metalworking, Plastics, finishing and plating, electronics manufacturing

Disassembly for End-of-life products: Methods for evaluating disassembly, active disassembly components, automatic disassembly, recovery / recycling of parts and materials

Industry Energy Efficiency: Benchmarking techniques, Utility bill analysis, energy efficiency measures for equipment Challenges to Green Manufacturing, Examples of Green Manufacturing.

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MMP521C: WEB AND NETWORKING TECHNOLOGIES LABORATORY

Practicals on:

XML, HTML, SAX and DOM parsing examples.

JSP, database connectivity using JSP

Servlet, database connectivity using Servlet

EJB3.1 examples, database connectivity using EJB

Ajax

MMP522C: CAM LABORATORY

Computer aided manufacturing: CNC Milling – 4 exercises, Generation of tool path, generation of NC code, Optimization of tool path (to reduce machining time) using any CAM software

Co-ordinate Measuring Machine: Case study: Inspection of a component using different probes, generation of report and interface (for example – Gears, Housings, Flywheels, Walls of machine structure, etc.)

RP Tooling: Introduction, simple prototype manufacturing

Assignments: on CAPP, APP, MPS, MRP, CP, SFC

MMP523C: PLM LAB – II

PDM Functions - Workflow Management, Project Management, Search Management,

Product Lifecycle Management (PLM) Concept and Special Functions

Creating Organization (Users, Roles, Group, Volume etc)

Defining rights (Object/Rule Based)

Creating required hierarchy of folders

Creating item, form, LOVs, dataset types

Defining business model (Naming Rule, Type Display Rule, Action Rule, Deep Copy Rule, GRM rules, Business

Modeler Import/Export Rules, Property Rule, Compound Property rule)

Customizing different queries and reports out of the box

Creating different workflows

Creating and managing engineering change

Adding custom attribute to forms / in class

Creating different BOM view (PSE)

Resource classification

CAD Integration

CAD Manager/ Embedded Client

Seed/Template Creation

Attribute Mappings – NX3, AutoCAD, Solid Edge

PDM Functionalities Mappings (Setting Customer Options etc)

Sample Data Migration

Removing Broken Links and Duplicates,

Associated Files (TIFF, CGM etc)

Attribute Mappings

Define Search File

Define Map File

Importing Data

Testing & QA

Typical Server Tests (Database Testing, Utilities Database and Volume, Backup & Restore)

Typical Client Tests (Rich client test, CAD client test, Web client test)

Industry Cases, Project Presentation

MMP524C: SEMINAR-II

The SEMINAR-II shall consist of few particulars amongst **literature review** based on a sizable number of publications. **Design / Development / Synthesis** related to a particular area. Implementation of existing theory for applications, pilot experiments etc. Each student is required to prepare a report and deliver a talk based on the work carried out as mini-project under the guidance of a faculty member(s). The work carried out should be preferable related to his/her dissertation topic.

AUDIT COURSE: PROFESSIONAL COMMUNICATION

Grammar and commonly misspelt words
Body language and presentation skills
Speech communication
Meetings, group discussions, seminars and conferences
Writing — resume, technical reports, articles and research papers.

MMP601: DISSERTATION PART I

The dissertation Part – I has the following two components:

1. Part Implementation of the main project
2. Proficiency Development (on a setup, software, or something relevant to the project topic)

Each component carries weightage and every student has to comply to all these components. The students will be evaluated separately for each of these components and shall be considered for collective performance in the score as Dissertation Part – I.

MMP602: DISSERTATION PART II

The dissertation work shall consist of an extensive work, study or analysis of field / industrial problems with appropriate solutions or remedies. The bonafide work carried out for Dissertation Part – II should be potentially rich in terms of academics.

Dissertation Report

The project report shall be hard bound. It is a report on the work done by the student. It should have literature review, problem definition and formulation, adopted methodology, experimentation plan if any, results, conclusions, discussion and its relevance to the further work.

Examination

The viva-voce examination of the Dissertation Part – II shall consist of a presentation by the candidate and demonstration of the work carried out.