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

MECHANICAL ENGINEERING DEPARTMENT

M. Tech. (Mechanical – Product Lifecycle Management)

Course Outline:

Group of subject	Subject Code	Subject	L	P	Credits	Mid Term	End Term	Sessi-onals / 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-528B	Students can register for any two from the list of electives provided	3	-	3	30	70	-	100
	MMP-521B to MMP-528B		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	-	-	-	-	-	-

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
MMP-528B	Customization of PLM software

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 PLM FUNDAMENTALS

Relevance of the course:

All industries that have tangible products need to understand PLM. Professionals who have responsibilities in engineering, manufacturing, or information systems or who have strategic planning responsibilities at the corporate or divisional levels will benefit from an understanding of PLM and its implementation.

Objectives of the course:

To present the latest material on PLM and its impact on the organization.

To provide an overview of the current thinking on the principles, strategies, practices, and applications of Product Lifecycle Management followed by an in-depth look at specific areas of PLM that are the focus of today's innovative organizations.

To provide conceptual underpinnings of PLM, along with the newest industry views on PLM applications.

To present frameworks which provide economic justifications for PLM projects and explain the pitfalls of a piecemeal approach to PLM.

Evaluation scheme:

Sr. No.	Component	Weightage (%)
1	Mid Term	30%
2	End Term	70%

Course contents:
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.

MMP-512A NEW PRODUCT DESIGN

Relevance of the course:

In this course the understanding of Product development process & methodologies are discussed along with types of design, importance of design, design considerations, product life cycle, technology life cycle, benchmarking and mass customization, stages, objectives and synchronized approaches in NPD. Prototyping with its basics helps to understand the functioning and visual look of product prior to its manufacturing with realistic examples. This course helps to solve the various case studies from automotive, aerospace, communication, etc. sectors.

Objective of the course:

To provide conceptual understanding of product design, product development process & methodologies.

To integrate product development process by identifying customer needs by gathering, interpreting, organizing and establishing relative importance of the customer needs.

To highlight on complete design, justification and analysis (simulation), tool design, plan manufacturing, material and process selection, tools and software selection, testing (quality check) and servicing the product.

To promote people for selecting and solving cases from various sectors with the help of product and process systemization, identification and solving methodologies, improving product development solutions.

Evaluation scheme:

Sr. No.	Component	Weightage (%)
1	Mid Term	30
2	End Term	70

Course contents:

Introduction: Types of design, importance of design, design considerations, product life cycle, technology life cycle, benchmarking and mass customization, 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

Reference 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
- **Bralla, James G.**, Handbook of Product Design for Manufacturing, McGraw Hill Pub. 1986

MMP 513A DATA MANAGEMENT (DM)

Relevance of the course:

Product Data Management (PDM) evolved into the now-a-days very popular Product Lifecycle Management (PLM) systems. Most of the CAD tools are marketed these days with in-built PDM systems. Design and manufacturing data is the core/heart of any industry's engineering activities. To bring products into the market in least possible time and at the lowest possible cost has been the motto of industries since ancient days. PLM tools have shown the path to integrate /collaborate for achieving these goals. DBMS like Oracle, My SQL, DB2, etc form the backbone of PLM collaboration tools like Teamcenter, Winchill, Matrix, Enovia/Smarteam, etc.

Databases are part of every organization's day to day activities. All fields of Mechanical/Production Engineering including engineering design, process planning, production planning and scheduling, shop floor management, MRP-1, MRP-2, ERP, SCM, sales and marketing, costing and estimation and manufacturing in general are flooded with management of a huge amount of data and its manipulation for running the day-to-day business activities. Information technology, Product data management and Product Lifecycle Management are keywords of successful operation of industries in the competitive global environment world over.

Objectives of the course:

To create awareness about importance of engineering databases in organizations

Introduction to use of soft computing tools like spreadsheets and database management software like Oracle, Visual FoxPro, MS Access, MS SQL, etc

Study database design concepts and issues.

Understand and practice use of various models like E-R model, Relational models.

Learn to use SQL for data definitions and manipulation.

Introduce the Production Engineers to the advanced DBMS concepts including Distributed databases, PDM, Client-Server and other architectures.

Learn data management issues like product structure, BOMs, product variants, change management, etc in PLM software.

Evaluation scheme:

Sr. No.	Component	Weightage (%)
1	Mid Term	30
2	End Term	70

Course contents:

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 (ELECTIVE) COMPUTER AIDED DESIGN (CAD)

Relevance of Course

CAD is an important industrial art extensively used in many applications, including automotive, shipbuilding, and aerospace industries, industrial and architectural design, Biomedical engineering, and many more. CAD is a part of the whole Digital Product Development (DPD) activity within the Product Lifecycle Management (PLM) process. Being the first and core activity, understanding of the subject helps study other downstream applications. Hence, it is equally useful for both M. Tech. courses in Mechanical CAD/CAM and PLM.

Objectives of Course

To understand use of computers in design process

To study the mathematical representation of surfaces and curves used in geometric modeling

To study facilities in different CAD Software

To study theory of solid modeling techniques

To study the basics of graphics programming required for CAD software development.

Evaluation Scheme-

Sr. No.	Component	Weightage (%)
1	Mid Term	30
2	End Term	70

Course contents:

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 tessalation / voxalization 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, Addision 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 namely** UG/NX, Solid Works, CATIA, Autodesk Inventor Professional, AutoCAD, Open CASCADE, ANSYS Design modeller, Pro/E

MMP 512B LEAN MANUFACTURING SYSTEMS

Relevance of the course:

In this subject the understanding and reimbursement of the lean manufacturing system is discussed along with (Just In Time) JIT production system. The subject emphasizes on waste elimination technique which can be widely implemented in any manufacturing and mass production industry. The general idea of Kanban system can help to counter problems & dealings of both suppliers and contractors. Shortening of production lead times along with set up time reduction helps for standardization of operations. Elements of lean production system help to manage lean enterprise as a career ladder.

Objective of the course:

- To provide conceptual understanding of JIT Logic along with Pull and Push production system.

- Implementation of JIT principles to waste elimination along with understanding of Japanese approaches.

- To emphasis on Kanban system to counter problems & dealings of both suppliers and contractors with the help of related Kanban cards.

- To make understanding of the rise of lean production along with birthplace, concrete example, company as community, final assembly plant, product development and engineering, changing customer demand and future of lean production.

- To promote people for creating an organization and installing business system to encourage lean thinking

Evaluation scheme:

Sr. No.	Component	Weightage (%)
1	Mid Term	30
2	End Term	70

Course contents:

Introduction to Lean Manufacturing: Production System and its types, Transition to Lean, Lean Thinking, Manufacturing Strategies, Benefits of Lean Manufacturing

Elements of Lean Manufacturing: Elimination of Waste, Value Stream Mapping, 5S, Kaizen Approach, Introduction to and comparative study of Toyota Production System, Total Productive Maintenance, Total Quality Management and Six Sigma, Lean Indicators and Organizational Performance

Cellular Manufacturing: Layouts, Group Technology - part families, clustering methods - Rank Order Clustering, Single-Pass Heuristic considering Capacities (Askin and Standridge), Clustering using Similarity Coefficients, Production Flow Analysis, Utility Layout

Just In Time Production System: JIT Philosophy, JIT implementation requirements, Production Smoothening – philosophy and methods, Pull system - Production Authorization, Kanban Systems, scheduling Kanban production, CONWIP system, Base Stock System, Inventory Management in JIT, Information Management in JIT

Shortening of Production Lead Times: Reduction of setup times, practical procedures for reducing setup time, Transfer Lots, Economic implications of setup time reduction, Standardization of operations, multi function workers and job rotation

Human Approach for Lean Implementation: Lean Leadership, Total Employment Involvement**,** Small Group Activities like Quality Circles, SMTs, etc.

Scheduling: Scheduling System Requirements, Bottleneck Scheduling, Single Machine Scheduling, Flow Shop Scheduling, Job Shop Scheduling

Text Books

- **Ronald G. Askin and Jeffrey B. Goldberg**, "Design and Analysis of Lean Production Systems"

- **Chasel Aquilino**, "Productions and Operations Management"
- **Yasuhiro Monden**, "Toyota 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".
- **Jeffrey Liker** "The Toyota Way : 14 Management Principles from the World's Greatest Manufacturer: 14 Management Principles from the World's Greatest Manufacturer"

MMP 513 B FINITE ELEMENT ANALYSIS (ELECTIVE)

Relevance of the subject: The objective of this subject is to teach numerical method like finite element analysis, which are used in the industries extensively. The topics on shape functions, element formulation, assembly procedure, and solution techniques help understand commercial FEA soft wares and its effective utilization. The subject improves the problem solving capabilities and useful for research in future.

Objectives:

To improve the problem solving ability using numerical method like FEA. To understand and use the commercial finite element packages effectively through hands on practice in the laboratory.

Evaluation Scheme:

Sr. No.	Component	Weightage (%)
1	Mid Term	30
2	End Term	70

Course contents:

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 symmetricity – 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, Galerikn 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. Huges**, 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

MMP 514 B ENTERPRISE RESOURCE PLANNING (ELECTIVE)

Relevance to industry:

In the product life cycle data sharing management is the key issue in the industries so through this course students should know different skills and concept for that such as ERP of data management

Objectives:

- Describe the concept of ERP and the ERP model; define key terms; explain the transition from MRP to ERP; identify the levels of ERP maturity.

- Describe the elements of a value chain, and explain how core processes relate; identify how the organizational infrastructure supports core business processes; explain the effect of a new product launch on the three core business processes.

- Identify the international issues that impact a worldwide implementation of ERP; identify the key technological considerations and infrastructure concerns in ERP implementation; describe the strategic use of technology for ERP.

- Explain how the key elements of organizational change management apply to an ERP implementation; define change readiness; describe a learning requirements plan; explain the use of assessment tools to identify the readiness of an organization to change; identify the methods of implementing and sustaining the change.

- Describe project organizational considerations; define the project management tools and resources needed to implement an ERP system; describe the roles and responsibilities of the key organization players; describe the tactics, tools, and methodologies available to implement ERP; evaluate the success of the implementation.

- Describe how the knowledge management capability of an ERP system can be used to sustain competitive advantage; describe how to use ERP to communicate effectively with customers and suppliers.

Evaluation scheme:

Sr. No.	Component	Weightage (%)
1	Mid Term	30
2	End Term	70

Course contents:

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

Reference Books / Learning Material

- **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
- **Rahul Altekar**, Enterprise Resource Planning
- APIC's material on ERP

MMP 515 B MECHATRONICS & ROBOTICS (ELECTIVE)

Relevance of course:

The course is relevant to the relations between Electronics and mechanical automation as mechanical students should be aware of the electronics applications in the mechanical automation and robotics .

Objectives:

Appreciate what Mechatronics is about.

Understand the role of sensors, actuators, control, and machine intelligence in product design.

Explain the requirements for signal conditioning.

Design and evaluate simple pneumatic, hydraulic and electronic circuits.

Evaluate the operational characteristics of electromechanical actuators (solenoids, motors, etc.)

To study different types of Robot related technologies and basics.

Understand various control modes.

Study system's transient and steady state behavior.

Course contents:

 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.

MMP 516 B RELIABILITY ENGINEERING & LIFE TESTING (ELECTIVE)

Relevance to industry: The course is relevant as customer satisfaction depends on product performance for the said purpose. Reliability analysis helps improve the reliability of any product or system which ultimately maintains the customers' base of any industry.

Objectives: The aim of this course is to understand various components or products or systems through its life cycle. The course helps perform the probabilistic time analysis of products' successes and failures. Thus the course helps to predict reliability of any component or system which is essential before we put it into any use.

Evaluation scheme:

Sr. No.	Component	Weightage (%)
1	Mid Term	30
2	End Term	70

Course contents:

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.

MMP – B 517 SHEET METAL MODELLING AND MANUFACTURING

Relevance of the course:

Study of mechanics of sheet metal forming, forming grade steel sheets-properties and applications, intrinsic sheet metal properties, sheet metal formability-key to customer satisfaction, formability- concept and assessment, forming limit diagram (FLD)- concept, measurement and applications, use of software for sheet metal forming analysis, common defects and failures in sheet metal forming-causes and remedies. The knowledge of this subject is very essential for an engineer in selection of various sheet metals for suitable application in industry

Objectives of the course:

To study strain and stress developed during sheet metal forming, volume constancy principle in sheet metal forming, elastic and plastic deformation, modes of deformations-deep drawing, bending, stretching and combination of types of forming.

Study steels used in automotive sheet metal parts manufacturing.

Study of significance and measurement of intrinsic material properties, strain hardening coefficient, strain rate sensitivity, normal and planar anisotropy.

Study of formability requirement from manufacturer perspective.

Study of formability and affecting factors.

Study of experimental determination of forming limit diagram

Study of sheet metal manufacturing from design to production .

Study of defects of metallurgical origin, defects which result from improper mechanical actions and defects due to elastic springback and generated residual stresses

Evaluation scheme:

Sr. No.	Component	Weightage (%)
1	Mid term evaluation	30-40%
2	End term evaluation	60-70%

Course contents:

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

Reference Books

1. **Dieter G. E. Bacon David**, Mechanical metallurgy, McGraw Hill, ISBN-0-07-100406-8

2. **Grobh Schuler**, Metal forming handbook, Springer Verlag Berlin, Heidelberg, 1998, ISBN-3-540-61185-1

3. **Cyril Donaldson, George H. Locain, V. C. goold**, Tool Design, Tata McGraw Hill, ISBN-0-07-099274-6

4. **Frank w. Wilson**, Fundamentals of tool design, ASTME, prentice Hall of India, New Delhi ISBN-0-87692-058-10

5. **Roy A. Lindberg**, Processes and materials of manufacturing, Prentice Hall of India, New Delhi, ISBN-81-203-0663-5

6. **Prakash H. Joshi**, Press tools: design and construction, Wheeler Publishing, New Delhi, ISBN-81-85814-46-5

MMP 511 C   PROGRAMMING LAB.

Relevance :

PLM engineers are required to understand and customize the PLM software for various applications and specific customer need, requirements. Therefore, DBMS and programming skills for customization of either the server or clients or the other middleware are essential.

Objective:

Develop understanding and skills of the following,

- C++ programming and related Integrated Development Environments (IDEs)

- Java programming and related IDEs

- Spreadsheet and DBMS packages like Oracle, Visual FoxPro / MS Access

- Programming in DBMS packages with SQL

Evaluation scheme:

Sr. No.	Component	Weightage (%)
1	Continuous evaluation	100

Course contents:
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

MMP 512C CAD/CAE LAB

Relevance of the course:

CAD/CAE is an important industrial art extensively used in many applications, including automotive, shipbuilding, aerospace industries, industrial architectural design and textile industries. CAD/CAE is one part of the whole Digital Product Development (DPD) activity which covers production planning and control too.

So study of CAD/CAE is essential for Engineering Students

Objective of the course:

To understand the concept of Analysis by various CAD/CAE software.

To develop basic knowledge and experience of engineering modeling & analysis concepts

To study various software's related to design, analysis, simulation, database etc and use of this software's.

To study the fundamentals of strength of materials, finite element method and applications of FEM.

To know basics of CAD /CAE Software.

To know elements of machine components.

Evaluation scheme:

Sr. No.	Component	Weightage (%)
01	Continuous Evaluation Scheme	100%

Course contents:
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

MMP- 513C PLM LAB-I

Relevance of the course:

Today industries are developing their products in short span of time, for that they are using software and tools such as CAD/CAE/CAM and PLM/ PDM. Through this course, students will have interface and practice with this type of software and tools.

Objectives of the course:

To study PLM software installation procedures and their architectures

To study prerequisites of PLM

To learn working of components of PLM software

To study implementation procedures of PLM

Evaluation scheme:

Sr. No.	Component	Weightage (%)
1	Continuous evaluation	100

Course contents:

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

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

MMP 514C SEMINAR-I

Relevance of the course:

Seminar gives opportunity to students to represent their skills and increases their interest towards research work.

Objectives of the course:

To study different types of recent technical research papers.

To learn to make technical seminar reports and presentations

To increase the presentation skills

Evaluation scheme:

Sr. No.	Component	Weightage (%)
1	Mid Term Evaluation	30
2	End Term Evaluation	70

Contents:

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.

MMP 521 A PROJECT MANAGEMENT

 Relevance to industry: The course is relevant as product developments are carried out as projects.

The software industry has specific application of this course as software developments are time phased tasks and software project management helps a lot towards timely completion and testing of softwares.

Objectives:

To inculcate the knowledge that is required to implement various projects.

It develops the vision for identification and formulation of the projects.

Various tools and techniques which are essential for smoother execution of projects are to taught in the course.

Succinctly, this course imparts the knowledge that can be applied to optimize time and resources in project implementation.

Evaluation scheme:

Sr. No.	Component	Weightage (%)
1	Mid Term	30
2	End Term	70

Course contents:

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

MMP 522 A WEB AND NETWORKING TECHNOLOGIES

Relevance to industry:

Collaborative product design and concurrent engineering is a reality today due to the availability of networking environment. Internet usage is increasing day by day and Web based engineering tools are a part of everyone's desktops now-a-days.

Objectives of the course:

To study web engineering skills

To develop skills in networking related issues and programming and software

Learn XML, HTML

Evaluation scheme:

Sr. No.	Component	Weightage (%)
1	Mid Term	30
2	End Term	70

Course contents:

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

MMP-523A   PLM: ADVANCED CONCEPTS

Relevance of the course:

This course will train the students so that they can work with latest technologies such as PLM/PDM, by going through this course they will be able to implement and develop such systems also which is the growing need of the industries today to have competitive edge.

Objectives of the course:

In this course the students will come to know global change management, Legacy System Integration & data transfer, product architecture, and CAD BOM alignment.

This course also has the terms and technologies such as workflow, product structuring visualization of data, architectures of PLM and students can work with PLM systems directly.

Integration of PLM systems with other systems.

Evaluation scheme:

Sr. No.	Component	Weightage (%)
1	Midterm Examination.	30%
2	Major (end term) Examination.	70%

Course contents:

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.

MMP-521B COMPUTER AIDED MANUFACTURING

Relevance of the course:

CAM is the use of a computer to assist in all operations of a manufacturing plant, including planning, management, transportation and storage. Its primary purpose is to create a faster production process. Now days in Industry various manufacturing systems are utilized such as CIM, FMS, GT, CAPP, etc.

Objectives:

The syllabus of this course is framed to teach modern aspects of manufacturing. CAM part deals with machines with increasing levels of computerization, along with required coding skill to operate these machines. Some concepts of general layouts that are used for automation, like production flow analysis, algorithms for material flow optimization, are also important and to learn different types of rapid prototyping techniques..

Evaluation scheme:

Sr. No.	Component	Weightage (%)
1	Mid Term	30
2	End Term	70

Course contents:

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

Relevance of the subject:

The numerical methods like FEA and CFD are extensively used in industries for analysis purpose. Processes involving fluid interactions and heat transfer applications need knowledge of these analysis techniques for the design of equipments.

Objective:

To prepare the students for the design and analysis of systems using fluids and heat transfer processes. The subject could form a basis of research in CAE and fluid structure interactions.

Evaluation scheme:

Sr. No.	Component	Weightage (%)
1	Mid term examination	30
2	End term examination	70

Course contents:

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 Modelling for CFD, DCW Industries.

MMP523B SUPPLY CHAIN MANAGEMENT

Relevance of the Course:

As a PLM Professional the students should knows the relation between the different concepts and related technologies such as SUPPLY CHAIN MANAGEMENT and CRM with PLM. As industries are looking to take advantage of all such technical and technologies to have the competitive advantaged in product development process..

Objectives:

- To develop an understanding of key drivers of supply chain performance and their inter-relationships with strategy and other functions of the company such as marketing, manufacturing and accounting.

- To impart analytical and problem solving skills necessary to develop solutions for a variety of supply chain management and design problems and develop an understanding for use of information technology in supply chain optimization.

- To understand the complexity of inter-firm and intra-firm coordination in implementing programs such as e-collaboration, quick response, jointly managed inventories and strategic alliances.

- To develop the ability to design logistics systems and formulate integrated supply chain strategy, so that all components are not only internally synchronized but also tuned to fit corporate strategy, competitive realities and market needs.

- To understand which information should be exchanged in a supply chain and how it should be used to benefit the entire supply chain.

- To identify improvement opportunities that exist within supply chains in different industries and to quantify the improvements that various supply chain strategies offer.

- To understand which barriers companies face during the implementation of new supply chain strategies.

Evaluation scheme:

Sr. No.	Component	Weightage (%)
1	Mid term examination	30
2	End term examination	70

Course contents:

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-makership 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 524 B   COMPOSITE MATERIALS TECHNOLOGY

Relevance: The course on composite materials is introduced to first year PG course with the objectives to impart knowledge related to advance materials like composites. Manufacturing methods and failure modes help to decide the design strategy for these materials.

Objective: To acquaint the students to composite materials technology so that appropriate composite can be designed for a particular application.

Evaluation scheme:

Sr. No.	Component	Weightage (%)
1	Mid term examination	30
2	End term examination	70

Course contents:

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

Relevance of course:

Manufacturing the product with shortest time is the aim of the today's industries to satisfy customers need so the related technologies are needed to be studied, this course teaches about digitization in manufacturing and to achieve the objectives of PLM.

Objectives:

To understand the challenges faced by manufacturing

To understand the importance of digital manufacturing for business processes

To understand the importance of DM in PLM

To understand digital manufacturing and its advantages

To understand and develop the digital work environment

To be proficient in using computer-aided technology to support the above.

To appreciate the need of DM for the Indian manufacturing industry.

To align with the objectives of the PLM course.

Evaluation scheme:

Sr. No.	Component	Weightage (%)
1	Mid term examination	30
2	End term examination	70

Course contents:

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.

MMP526 B DESIGN FOR 'X'

Relevance of course:

It is well received that complete technical knowledge and step-wise operations during the design/manufacturing/ services are needed to be aware about before the process is put to automation. Computer application through automation has becoming an important issue in each of the phases of product life cycle and production cycle. Therefore, the course is aimed to provide the necessary information and fresh up the fundamental knowledge in context of automation.

Objective:

In view of automation system development for different stages in product life cycle, the course DF"X" aims with the following objectives:

To understand the DF"X" procedures and preview with respect to product life cycle.

DF"X" tools used and their functions are aware of for its implementation in concurrent engineering approach.

Students should be able to apply the learnings for Design for: Assembly, Disassembly, Reliability, Heat Treatment, Technical Merit, Assorted technical requirements/processes etc.

Evaluation scheme:

Sr. No.	Component	Weightage (%)
1	Mid term examination	30
2	End term examination	70

Course contents:

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, Dimentional 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. Wihelm 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

MMP527 B GREEN MANUFACTURING

Relevance of course:

Environmentally responsible technologies and conservations of natural resources are coming up de-facto standards in industries.

Objectives of the course:

To create awareness about environmentally responsible product design requirements.

To apple use of environmental friendly material and processes in product engineering.

Aptitude development towards Material /component recovery at end of life of a product be analysed and apple for their uses.

Evaluation scheme:

Sr. No.	Component	Weightage (%)
1	Mid term examination	30
2	End term examination	70

Course contents:

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

MMP528 B CUSTOMIZATION OF PLM SOFTWARE (CPLMS)

Relevance of the Course:

LPG related policies of the Government world over have increased the demand for digital engineering services with a broad number of new engineering technologies

Ranging from Data Exchange Service to CAD data Designing and Modeling Service, CAE Analysis and simulation, CAD Data Conversion Service, PLM solution and Outsourcing Services

CAD /CAM/CAE/PLM companies providing these services work with vision to bring over innovative technologies and unique solutions to help organizations grow competitively.They provide value added solution and services in the area of new engineering technologies.

Most CAD/CAM software are designed with features that may not be suitable to the customers day to day specific /specialized needs. Many industries provide system customisation services, to design solutions according to custom requirements and business need, making the work and life easier.

The course is aimed to enable students understand customization concepts and develop skills related to customization of CAD/CAM software.

Objectives of the Course:

a. Understand rapid development concepts, SDLC and Prototyping

b. Learn to add more features and functions in the existing PLM software tools

c. Study user interface customization, e.g. Icon/ menu, naming and arrangement.

d. Study API in NX or CATIA or Autodesk software products

e. Program development to control and link between CAD /CAE and EXCEL Data

f. Study and develop TC customization skills.

Evaluation scheme:

Sr. No.	Component	Weightage (%)
1	Mid term examination	30
2	End term examination	70

Course Contents:

Introduction to customization, need, types; introduction, Basic customization concepts, common customization tasks, software engineering concept; Software Development Life Cycle (SDLC), Requirement analysis, Rapid application Development (RAD) tools, programming languages. Customisation of World processing and spreadsheet tools

CAD modeling software customization; overview, system development and general purpose customization tools for any one of software like NX, CATIA, etc; Overview of CAE software (like ANSYS, Hypermesh, NASTRAN etc) customisation.

OOP and C++ programming concepts

TC customization using BMIDE, ITK, Rich/thin clients; PLM s/w (TC) Architecture and POM schema; Overview of customization in Enovia/Smarteam, Windchill PLM, ARAS; Integration of TC with other software

References:

1. McMohan; CAD/CAM/CIM; Addsion Wesley Publishiers

2. Teamcenter Documentation /Help Manuals,

      a. Getting started with Customisation,

      b. Thin client customisation –Programmer's Guide

      c. Integration Toolkit Programmer's Guide

      d. Business Modeler IDE Guide,

      e. Application interface Web Service (AIWS) configuration and customization Guide.

      f. Rich Client Customisation- Programmer's Guide,

3. NX documentation for open C/C++, GRIP, Knowledge fusion

4. Software documentation for Word, Excel, Access, ANSYS, Abacus, etc

MMP521C WEB AND NETWORKING TECHNOLOGIES LABORATORY

Relevance of course:

Collaborative product design and concurrent engineering is a reality today due to the availability of networking environment. Internet usage is increasing day by day and Web based engineering tools are a part of everyone's desktops now-a-days.

Objectives of the course:

- To study web engineering skills

- To develop skills in networking related issues and programming and software

- Learn XML, HTML

Evaluation scheme:

Sr. No.	Component	Weightage (%)
1	Continuous evaluation	100

Course contents:

Praticals 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.

MMP- C 522 CAM LAB

Objectives of the course:

To study the working of various machines such as CNC Lathe, Laser drilling, EDM etc. To have Hands on The various operations of these machines..

Evaluation Scheme:

Sr. No.	Component	Weightage (%)
1	Continuous Evaluation.	100%

Course contents:

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

MMP- 523C PLM LAB-II

Relevance of the course:

Data management is the key issue for the OEM and designers, so through this course student will develop this skill which will enhance their ability to develop and implement software for the same.

Objectives of the course:

To study functions of the PDM.

To study working of different Modules of PLM.

To study integration of PLM with different software.

Evaluation scheme:

Sr. No.	Component	Weightage (%)
1	Continuous evaluation	100

Course contents:

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

Relevance of the course:

Seminar II gives opportunity to students to learn/study topics in the area of their interest. probably that will show them the way towards project work in second part.

Objectives of the course:

To study and conduct mini projects/case studies.

To study different types of recent technical research papers.

To increase the presentation skills.

Evaluation scheme:

Sr. No.	Component	Weightage (%)
1	Mid Term Evaluation	30
2	End Term Evaluation	70

Course contents:

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

Relevance of the course:

Good communication is required to be a good engineering professional; this course helps to enhance the communication and personality of the students.

Objectives of the course:

To study English language to have superior communication.

To have good personality.

To increase the presentation skills.

Evaluation scheme:

Sr. No.	Component	Weightage (%)
1	Continuous Evaluation.	100%

Course contents:

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

Relevance of the course:

The dissertation of the M. Tech. project will enhance the research qualities of the students,

This results in better projects and research. In this way they can contribute to industries and society.

Objectives of the course:

To learn to do research.

To invent / study newer technology.

To find solutions to realistic industrial problems.

Evaluation scheme:

Sr. No.	Component	Weightage (%)
1	Part Implementation	25
2	Proficiency Development	25
3	End term dissertation I.	50

Course contents:

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

Relevance of the course:

The dissertation of project will enhance the research qualities of the students, this results in better projects and research. In this way they can contribute to industries and society.

Objectives of the course:

To find solutions to realistic industrial problems and optimize those.

To learn to do research.

To develop/ invent newer technology and software.

Evaluation scheme:

Sr. No.	Component	Weightage (%)
1	Part Implementation	30
2	Dissertation II.	70

Contents:

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.