Visvesvaraya Technological University, Belagavi
MTech(Product Design and Manufacturing)
Tentative Scheme of Teaching and Evaluation
(Academic year 2018–19)

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
Scheme of Teaching and Examination – 2018 - 19
M.Tech In Product Design and Manufacturing Engineering(MPD)
Outcome Based Education(OBE) and Choice Based Credit System (CBCS)

I SEMESTER

Sl. No	Course	Course Code	Course Title	Teaching Hours /Week		Examination				Credits
				Theory	Practical/ Field work/ Assignment	Duration in hours	CIE Marks	SEE Marks	Total Marks	
1	PCC	**18MPD11**	MATHEMATICAL METHODS IN ENGINEERING	04	--	03	40	60	100	4
2	PCC	**18MPD12**	Product Design and Development	04	--	03	40	60	100	4
3	PCC	**18MPD13**	Finite Element Analysis	04	--	03	40	60	100	4
4	PCC	**18MPD14**	Product life cycle Management	04	--	03	40	60	100	4
5	PCC	**18MPD15**	Advanced Materials & Processing	04	--	03	40	60	100	4
6	PCC	**18MPDL16**	Basic Product Design Lab-1	-	04	03	40	60	100	2
7	PCC	**18RMI17**	Research Methodology and IPR	02	--	03	40	60	100	2
			TOTAL	**22**	**04**	**21**	**280**	**420**	**700**	**24**

Note: PCC: Professional core, PEC: Professional Elective.

Internship: All the students have to undergo mandatory internship of 6 weeks during the vacation of I and II semesters and /or II and III semesters. A University examination shall be conducted during III semester and the prescribed credit shall be counted for the same semester. Internship shall be considered as a head of passing and shall be considered for the award of degree. Those, who do not take-up/complete the internship shall be declared as failed and have to complete during the subsequent University examination after satisfying the internship requirements.

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II SEMESTER

Sl. No	Course	Course Code	Course Title	Teaching Hours /Week		Examination				Credits
				Theory	Practical/ Field work/ Assignment	Duration in hours	CIE Marks	SEE Marks	Total Marks	
1	PCC	**18MPD21**	Industrial Design & Ergonomics	04	--	03	40	60	100	4
2	PCC	**18MPD22**	Design for Manufacturing	04	--	03	40	60	100	4
3	PCC	**18MPD23**	Product Planning & Marketing	04	--	03	40	60	100	4
4	PEC	**18MPD24X**	Professional elective 1	04	--	03	40	60	100	4
5	PEC	**18 MPD 25X**	Professional elective 2	04	--	03	40	60	100	4
6	PCC	**18 MPD L26**	Product Design Lab-2	--	04	03	40	60	100	2
7	PCC	**18 MPD 27**	Technical Seminar	--	02	--	100	--	100	2
TOTAL				**20**	**06**	**18**	**340**	**360**	**700**	**24**

Note: PCC: Professional core, PEC: Professional Elective.

Professional Elective 1		**Professional Elective 2**	
Course Code under 18MPD24X	**Course title**	**Course Code under 18 MPD 25X**	**Course title**
18 MPD 241	Product Data Management	**18 MPD 251**	Quality & Reliability Engineering
18 MPD 242	Advanced Manufacturing Practices	**18 MPD 252**	Virtual Design and Manufacturing
18 MPD 243	Non Traditional Machining Process	**18 MPD 253**	Lean Manufacturing System

Note:
1. Technical Seminar: CIE marks shall be awarded by a committee comprising of HoD as Chairman, Guide/co-guide, if any, and a senior faculty of the department. Participation in the seminar by all postgraduate students of the same and other semesters of the programme shall be mandatory.
The CIE marks awarded for Technical Seminar, shall be based on the evaluation of Seminar Report, Presentation skill and Question and Answer session in the ratio 50:25:25.
2. Internship: All the students shall have to undergo mandatory internship of 6 weeks during the vacation of I and II semesters and /or II and III semesters. A University examination shall be conducted during III semester and the prescribed credit shall be counted in the same semester. Internship shall be considered as a head of passing and shall be considered for the award of degree. Those, who do not take-up/complete the internship shall be declared as failed and have to complete during the subsequent University examination after satisfying the internship requirements.

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III SEMESTER

Sl. No	Course	Course Code	Course Title	Teaching Hours /Week		Examination				Credits
				Theory	Practical/ Field work/ Assignment	Duration in hours	CIE Marks	SEE Marks	Total Marks	
1	PCC	**18MPD31**	Product Analysis and cost optimization	04	--	03	40	60	100	4
2	PEC	**18MPD32X**	Professional elective 3	04	--	03	40	60	100	4
3	PEC	**18MPD33X**	Professional elective 4	04	--	03	40	60	100	4
4	Project	**18MPD34**	Evaluation of Project phase -1	--	02	--	100	--	100	2
5	Intenship	**18MPDI35**	Internship	(Completed during the intervening vacation of I and II semesters and /or II and III semesters.)		03	40	60	100	6
TOTAL				12	02	12	**260**	**240**	**500**	**20**

Note: PCC: Professional core, PEC: Professional Elective.

Professional elective 3		**Professional elective 4**	
Course Code under 18MPD32X	**Course title**	**Course Code under 18MPD33X**	**Course title**
18MPD321	Optimization Techniques for Decision Making	18MPD331	Robust Design
18MPD322	Rapid Prototyping	18MPD332	Simulation and Modeling
18MPD323	Value Engineering	18MPD333	Computer Application in Design

Note:
1. Project Phase-1: Students in consultation with the guide/co-guide if any, shall pursue literature survey and complete the preliminary requirements of selected Project work. Each student shall prepare relevant introductory project document, and present a seminar.
CIE marks shall be awarded by a committee comprising of HoD as Chairman, Guide/co-guide if any, and a senior faculty of the department. The CIE marks awarded for project work phase -1, shall be based on the evaluation of Project Report, Project Presentation skill and Question and Answer session in the ratio 50:25:25.
SEE (University examination) shall be as per the University norms.
2. Internship: Those, who have not pursued /completed the internship shall be declared as failed and have to complete during subsequent University examinations after satisfying the internship requirements.
Internship SEE (University examination) shall be as per the University norms.

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IV SEMESTER

Sl. No	Course	Course Code	Course Title	Teaching Hours /Week		Examination				Credits
				Theory	Practical/ Field work/ Assignment	Duration in hours	CIE Marks	SEE Marks Viva voce	Total Marks	
1	Project	**18MPD41**	Project work phase -2	--	04	03	40	60	100	20
			TOTAL	--	**04**	**03**	**40**	**60**	**100**	**20**

Note:

1. Project Phase-2:

CIE marks shall be awarded by a committee comprising of HoD as Chairman, Guide/co-guide, if any, and a Senior faculty of the department. The CIE marks awarded for project work phase -2, shall be based on the evaluation of Project Report subjected to plagiarism check, Project Presentation skill and Question and Answer session in the ratio 50:25:25.

SEE shall be at the end of IV semester. Project work evaluation and Viva-Voce examination (SEE), after satisfying the plagiarism check, shall be as per the University norms.

SYLLABUS
SEMESTER - I

PRODUCT DESIGN AND DEVELOPMENT

Subject Code : 18MPD12 **Exam Hours : 03**
CIE Marks : 40 **SEE Marks : 60**
No. of Lecture Hours/Week : 4 **Credits:4**
Total No. of Lecture Hours : 52

Module -1

Introduction: Characteristics of successful product development, Design and development of products, duration and cost of product development, the challenges of product development.

Development Processes and Organizations: A generic development process, concept development: the front-end process, adopting the generic product development process, the AMF development process, product development organizations, the AMF organization.

Product Planning: The product planning process, identify opportunities. Evaluate and prioritize projects, allocate resources and plan timing, complete pre project planning, reflect all the results and the process.

10 HOURS

Module - 2

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.

Product Specifications: What are specifications, when are specifications established, establishing target specifications, setting the final specifications.

Concept Generation: The activity of concept generation, clarifies the problem, search externally, search internally, explore systematically, reflect on the results and the process.

12HOURS

Module -3

Concept Selection: Overview of methodology, concept screening, and concept scoring,

Concept Testing: Define the purpose of concept test, choose a survey population, choose a survey format, communicate the concept, measure customer response, interpret the result, reflect on the results and the process.

Product Architecture: What is product architecture, implications of the architecture, establishing the architecture, variety and supply chain considerations, platform planning, related system level design issues.

10 HOURS

Module -4

Industrial design: Assessing the need for industrial design, the impact of industrial design, industrial design process, managing the industrial design process, assessing the quality of industrial design.

Design for Manufacturing: Definition, estimation of manufacturing cost, reducing the cost of components, assembly, supporting production, impact of DFM on other factors.

Prototyping: Prototyping basics, principles of prototyping, technologies, planning for prototypes.

10 HOURS

Module -5

Product Development Economics: Elements of economic analysis, base case financial mode,. Sensitive analysis, project trade-offs, influence of qualitative factors on project success, qualitative analysis.

Managing Projects: Understanding and representing task, baseline project planning, accelerating projects, project execution, postmortem project evaluation.

10 HOURS

TEXT BOOK:

1. **Product Design and Development -** Karl.T.Ulrich, Steven D Eppinger - Irwin McGrawHill - 2000.

REFERENCE BOOKS:

1. Product Design and Manufacturing - A C Chitale and R C Gupta, PH1, - 3rd Edition, 2003.

2. New Product Development - Timjones. Butterworth Heinmann -Oxford. UCI -1997

3. Product Design for Manufacture and Assembly - GeofferyBoothroyd, Peter Dewhurst and Winston Knight - 2002

FINITE ELEMENT METHODS

Subject Code	18MPD13	**CIE Marks**	40
No. Of Credits	04	**SEE Marks**	60
Hrs/Week	04	**Exam Hours**	3
Total Hours	50		

Course Learning Objectives:

CL01	To learn basic principles of finite element analysis procedure
CL02	To learn the theory and characteristics of finite elements that represent engineering structures.
CL03	To learn and apply finite element solutions to structural, thermal, dynamic problem to develop the knowledge and skills needed to effectively evaluate finite element analyses.
CL04	

Module -1

Introduction: Equations of equilibrium, stress-strain relations for 2-D and 3-D, Potential energy and equilibrium, Boundaryconditions, Von Misses Stresses

FEM for 1-D Problems: General procedure for FEA, Raleigh Ritz method, Galerkin Approach, shape functions, stiffness matrix, loadvectors, temperature effects, Applications of boundary conditions using elimination and penalty approaches,

Module -2

FEM for 1 D and 2-D Problems: Application problems – 1-D bar element. Trusses and beams, Shape functions (2D element), stiffness matrix, strain matrix, load vectors for CST Elements and application problems

Module -3

FEM for Axisymmetric Problems: Axisymmetric formulation, triangular elements, PE approach, Body force term, applicationproblems

Module -4

FEM for Scalar Field Problems: 1-D Steady state heat transfer, torsion, potential flow and fluid flow in ducts andapplicationproblems

Module -5

Dynamic Analysis: Equations of motion for dynamic problems --consistent and lumped mass matrices –formulationof element massmatrices free vibration and forced vibration problems formulation.

REFERENCE BOOKS:

1. **Introduction to Finite Elements in Engineering –** Tirupathi R.- Chandrupatla Ashok DBelegundu -Prentice Hall India Pvt. Ltd., New Delhi – 3rd Edition, 2003

2. **Concepts and Applications of finite Element Analysis** - Cook R.D - Malkus D.S &PleshaM.E – JohnWiley& Sons - 1989.

3. **Applied Finite Element Analysis** -Segerlind L.J - John Wiley & Sons Edition- 1984.

4. **The Finite Element Method in Engineering**, - Rao SS Pergomon Press – Oxford - 2ndEdition, 1984.

5. **Finite Element Procedures in Engineering Analysis** - Bathe K .J - Prentice Hall NewJersey- 1982.

6. **Energy and Finite Element Methods in Structural mechanics** - Shames III &Dym C L -Wiley eastern ltd– 1995.

Course Outcomes

Upon successful completion of this course you should be able to:

1. Understand the concepts behind formulation methods in FEM.

2. Identify the application and characteristics of FEA elements such as bars, beams, plane and iso-parametric elements

3. Develop element characteristic equation and generation of global equation.

4. Able to apply suitable boundary conditions to a global equation for bars, trusses, beams, circular shafts, heat transfer, fluid flow, axi symmetric and dynamic problems and solve them displacements, stress and strains induced.

PRODUCT LIFE CYCLE MANAGEMENT

Subject Code : 18MPD14 **Exam Hours : 03**
CIE Marks : 40 **SEE Marks : 60**

No. of Lecture Hours/Week : 4 **Credits:4**
Total No. of Lecture Hours : 50

Module -1

Product life cycle management – Need for PLM, Components of PLM, Product Data and Product workflow, Drivers for Change.

10 HOURS

Module -2

The PLM Strategy, Developing a PLM Strategy, A Five-step Process, Strategy Identification and Selection, Strategy Elements, Implications of Strategy Elements, Policies, Strategy Analysis, Communicating the Strategy.

10 HOURS

Module -3

Change Management for PLM, Configuration management, Cost of design changes, schemes for concurrent engineering,Design for manufacturing and assembly, robust design, failure mode and effect-analysis.

10 HOURS

Module -4

Modeling, Current concepts, part design, sketching, use of datum's construction features, free ovulation, pattering, copying, and modifying features, reference standards for datum specification, Standards for Engineering data exchange

10 HOURS

Module -5

Tolerance mass property calculations, rapid prototyping and tooling, finite modeling and analysis, general procedure, analysis techniques,Finite element modeling.Applicability of FEM, Static analysis, thermal analysis, dynamic analysis.

10 HOURS

REFERENCE BOOKS:

1. **Product Lifecycle Management Paradigm for century Product Realization -** John Stark, Springer-Verlag, **21st**, London, 3rd printing -2006. 441 pp., ISBN: 1-85233-810-5.
2. **CAD/CAM Theory and Practice -** Zeid, McGraw Hill.- 1991.
3. **Computer Integrated Design and Manufacturing**, - Mark Henderson & Philip Wolfe, BedworthMcGraw hill inc.- 1991.
4. **Part modeling Users Guide**, Engineer - I998.

ADVANCED MATERIALS & PROCESSING

Subject Code: 18MPD15	**CIE MARKS: 40**
Number of Lecture Hours/Week: 04	**SEE Marks : 60**
Total Number of Lecture Hours: 50	**Exam Hours: 03**

MODULE 1

Classification and characteristics: Metals, Ceramics, Polymers and composites.

General properties and structure: Atoms, molecules bonds in solids, Crystalline - Defects in Metallic structure, Dislocations and plastic deformation - Strengthening mechanism - grain size, dislocation - Cold work, precipitation hardening, dispersion hardening - phase reactions, fatigue and Creep behavior.

MODULE 2

Ferrous Alloys: iron carbon equilibrium diagrams - Steels and cast irons - properties, structure, composition and applications transformation hardening in steels - TIT diagrams - Heat treatment processes - Effect of alloying elements - High alloy steels, Stainless steel types, tool Steels, Manganese steels, heat resistant steels, HSLA, Maraging steels.

MODULE 3

Non Ferrous alloys: Alloys of copper, Aluminum, nickel, magnesium, titanium, lead, tin, Zinc - composition, heat treatment, structure, properties and application.

MODULE 4

Polymers and polymerizations: Structure and properties of thermoplastics and thermo sets – Engineering Applications - property modifications - Mechanical and thermal behavior – processing methods.

Ceramics : Nature and structure of Ceramics - Refractory Abrasives glasses - glass ceramics - Advanced ceramics processing methods.

MODULE 5

Composites : Definition - classification and characteristics of composite materials - Volume fraction - laminated composites particulate composites, fibrous composites - Types of reinforcements, their shape and size - production and properties of fiber reinforced plastics, Metal Matrix composites and ceramic matrix composites - Applications.

Processing of Polymers: composites, ceramics - thermal spraying - Ion beam machining diamond coating techniques-tribological Applications.

REFERENCE BOOKS:

1. **Engineering Metallurgy** - Raymond and Higgens - ELBS/EA
2. **Introduction to Material Science and Engineering** - James.F.Shackleford - McMillan, NY - 7th edition.
3. **Powder Metallurgy-Metals Hand Book -**ASM, USA - Vol.7, 1974.
4. **Composite Materials - Science and Engineering** - Chawla K.K. ,Springer - Verlag, Newyork -2nd edition, 1998.
5. **Cast Metal Matrix Composites** ASM Metals Hand Book - P.K. Rohagti - VI5.
6. **Elements of Material science and Engineering** - Van Vlack L.H. - Addison Wesley, NY - 1989.

BASIC PRODUCT DESIGN LABORATORY -1

Subject Code : 18MPDL16 **Exam Hours : 03**
CIE Marks : 40 **SEE Marks : 60**
No. of Practical Hours/Week : 4 **Credits:2**
Total No. of Practical Hours : 30

1. Static (Structural) Analysis of 1-D problems
2. Static (Structural) Analysis of plane stress and Plane Strain problems
3. Structural Analysis of Trusses
4. Static Analysis of Axis Symmetric problems
5. Transient Heat Transfer Analysis of 1D problems
6. Transient Heat Transfer Analysis of 2D problems
7. Heat Transfer Analysis of Axis Symmetric Problems
8. Dynamic Analysis of 1D problems – Free vibration Analysis
9. Non-linear Static Analysis – Typical problems in geometric and material non-linear Analysis
10. Buckling Analysis of Shell Structures

REAEARCH METHODOLOGY AND IPR

Subject Code : 18RMI17 **Exam Hours : 03**
CIE Marks : 40 **SEE Marks : 60**
No. of Lecture Hours/Week : 2 **Credits:2**
Total No. of Practical Hours : 20

RESEARCH METHODOLOGY

Introduction: Meaning, Objectives and Characteristics of research - Research methods Vs Methodology - Types of research - Descriptive Vs. Analytical, Applied Vs. Fundamental, Quantitative Vs. Qualitative, Conceptual Vs. Empirical - Research process - Criteria of good research - Developing a research plan.

Defining the research problem - Selecting the problem - Necessity of defining the problem - Techniques involved in defining the problem - Importance of literature review in defining a problem - Survey of literature - Primary and secondary sources - Reviews, treatise, monographs patents - web as a source - searching the web - Identifying gap areas from literature review - Development of working hypothesis. **10 Hrs**

BASIC PRINCIPLES OF IP LAWS

Introduction: History, Concept of property, Constitutional aspects of IP, Basis for protection, Invention, Criteria for patentability, Non – patentable inventions.

Patents: Introduction, Origin and meaning of the term patent, Objective of a patent law, principles underlying the patent law in India, patentable invention, Overview of Procedure for obtaining patent and patent rights

Transfer of patent: Forms of transfer of Patent rights, Assignment, kinds of assignment, License, kinds of license, Rights conferred on a licensee, Transmission of patent by operation of law.

Trade Marks: Introduction, Statutory authorities, procedure of registration of trademarks, rights conferred by registration of trademarks, licensing in trade mark. **10 Hrs**

TEXT BOOKS:

1. Kothari, C.R., 1990. Research Methodology: Methods and Techniques. New Age International. 418p.
2. Garg, B.L., Karadia, R., Agarwal, F. and Agarwal, U.K., 2002. An introduction to Research Methodology, RBSA Publishers.
3. T. M Murray and M.J. Mehlman, Encyclopedia of Ethical, Legal and Policy issues in Biotechnology, John Wiley & Sons 2000

REFERENCE BOOKS:

1. Trochim, W.M.K., 2005. Research Methods: the concise knowledge base, Atomic Dog Publishing. 270p.
2. Day, R.A., 1992.How to Write and Publish a Scientific Paper, Cambridge University Press.
3. Fink, A., 2009. Conducting Research Literature Reviews: From the Internet to Paper. Sage Publications
International Economics, Washington, DC, 2000

SYLLABUS
SEMESTER - II

INDUSTRIAL DESIGN & ERGONOMICS

Subject Code : 18MPD21 **Exam Hours : 03**
CIE Marks : 40 **SEE Marks : 60**
No. of Lecture Hours/Week : 4 **Credits:4**
Total No. of Lecture Hours : 50

Module 1

Introduction: An approach to industrial design -elements of design structure for industrial design in engineering application in modern manufacturing systems.

Ergonomics and Industrial Design: Introduction -general approach to the man- machine relationship- workstation design-working position.

10 HOURS

Module 2

Control and Displays: Shapes and sizes of various controls and displays-multiple, displays and control situations - design of major controls in automobiles, machine tools etc
Ergonomics and Production: ergonomics and product design -ergonomics in automated systems- expert systems for ergonomic design. Anthropometric data and its applications in ergonomic, design- limitations of anthropometric data- use of computerized database.

10 HOURS

Module 3

Visual Effects of Line and Form: The mechanics of seeing- psychology of seeing general influences of line and form.
Colour: Colour and light -colour and objects- colour and the eye -colour consistency- colour terms- reactions to colour and colour continuation -colour on engineeringequipments.

10 HOURS

Module 4

Aesthetic Concepts: Concept of unity- concept of order with variety -concept of purpose style and environment- Aesthetic expressions. Style-components of style- house style, observation style in capital goods, case study.

10HOURS

Module 5

Industrial Design in Practice: General design -specifying design equipments- rating the importance of industrial design -industrial design in the design process.

10 HOURS

REFERENCE BOOKS:

1. **Industrial Design for Engineers -** Mayall W.H. - London Hiffee books Ltd.-1988.
2. **Applied Ergonomics Hand Book -** Brain Shakel (Edited) - Butterworth scientific. London
3. **Introduction to Ergonomics -** R. C. Bridger - McGraw Hill Publications -1995.
4. **Human Factor Engineering** - Sanders & McCormick - McGraw Hill Publications – 6^{th}edition,2002.

DESIGN FOR MANUFACTURING

Subject Code : 18MPD22 **Exam Hours : 03**
CIE Marks : 40 **SEE Marks : 60**
No. of Lecture Hours/Week : 4 **Credits:4**
Total No. of Lecture Hours : 52

Module 1

Material and process selection – Introduction, Advantages of applying DFMA, General requirements of early materials and process selection, Selection of Manufacturing processes, Selection of materials.

Engineering Design features. – Dimensioning, Tolerances, General Tolerance, Geometric Tolerances, Assembly limits, achieving larger machining tolerances, Datum features.

12HOURS

Module 2

Component design – Machining Considerations – Drills, Milling cutters, Drilling, Keyways, Dowels, Screws, Reduction in marhining areas, Simplication by separation and amalgamation, work piece holding, surface grinding,Examples

10HOURS

Module 3

Component design – Casting Considerations – Pattern, Mould, parting line, cast holes, machined holes, identifying parting line, special sand cores, designing to obviate sand cores. Examples

10 HOURS

Module 4

Design for Injection molding and Sheet metal working – Injection molding materials, Molding cycle, Systems, molds, machine size, cycle time, Cost estimation, Insert molding, Design guidelines, Introduction to sheet metalworking, Dedicated Dies and Press working, Press selections, Design Rules.

10 HOURS

Module 5

Design for Die casting and Powder metal processing – Die casting alloys, cycle, machines, dies, finishing, Assembly techniques, Design principles, Powder metallurgy processing, stages, compaction characteristics, Tooling, Sintering, Design guidelines.

10 HOURS

REFERENCE BOOKS:

1. **Product Design for Manufacture and Assembly** – Geoffrey Boothroyd - Peter Dewhurst - Winston Knight
   – Marcel Dekker, Inc. – Newyork - Second Revison, ISBN 0-8247-0584-X.
2. **Designing for Manufacturing** – Harry Peck - Pitman Publications –1983.
3. **Dimensioning and Tolerancing for Quantity Production** – Merhyle F Spotts –Inc. Englewood Cliffs - New Jersey - Prentice Hall, 5thedition.

PRODUCT PLANNING AND MARKETING

Subject Code : 18MPD23 **Exam Hours : 03**
CIE Marks : 40 **SEE Marks : 60**
No. of Lecture Hours/Week : 4 **Credits:4**
Total No. of Lecture Hours : 50

MODULE 1

Product strategy and planning product - market evolution, successful product development process, characteristics of successful product development

New Product Strategy: Strategic response, reactive verses proactive strategies, marketing verses Research and Development, Comprehensive strategy.

10 HOURS

MODULE 2

Proactive new product development process - Sequential decision process, reasons for product failure and strategies to avoid failures, cost, time, risk and expected benefit in new product development.

10 HOURS

MODULE 3

Opportunity Identification - Market definition and entry strategy, desirable characteristics of markets, market profile analysis, methods for market definition, target group selection through market segmentation, market selection, idea generation – idea sources, method of generating ideas, idea management.

10HOURS

MODULE 4

Consumer measurement and Perceptual mapping – Consumer measurement process**,** research methods,sampling, measuring instruments, attitude scaling, Consumers perceptions of new and existing products: Perceptual positioning, Perceptual maps, Analytic Methods used to produce Perceptual maps, Managerial review of maps.

Product positioning – Preference analysis and benefits, segmentation- Role of preference in product positioning, proactive product positioning, Analytic preference models and estimation methods, Benefit segmentation, managerial use of preference models.

10HOURS

MODULE 5

Forecasting sales potential – Roleof purchase potential in design process, models of purchase potential, models of sales formation, managerial use of purchase models.

Launching the products and Strategy for Testing new products – Planning and tracking launch of durable and industrial products, advertising testing and product quality testing

10HOURS

TEXT BOOKS:

1. Glen L. Urban. .John R. Hauser, "**Design and Marketing of New products"** A Prentice Hall, Englewood cliffs, New Jersey, 1993

2. William L. Moore & Edgar, "**Product Planning and Management**", A. Pessemier

PRODUCT DATA MANAGEMENT

Subject Code : 18MPD241 **Exam Hours : 04**
CIE Marks : 40 **SEE Marks : 60**
No. of Lecture Hours/Week : 4 **Credits:4**
Total No. of Lecture Hours : 50

Module 1

Product Data Management : Product life cycle, Complexity in Product Development, General Description of PDM
Basic functionality of PDM: Information architecture, PDM System architecture, Applications used in PDM systems. Trends in PDM

10 HOURS

Module 2

Document Management Systems: Document management and PDM, Document life cycle, Content Management, Document management and related technologies, Document management resources on the Internet

10 HOURS

Module 3

Workflow Management in PDM: Structure Management, Engineering Change Management, Release Management, Version Management, Configuration Management

10HOURS

Module 4

Creating Product Structures: Part centric approach, CAD centric approach, Product Structure configuration, Managing Product Structures,PDM Tools: Matrix One, TeamCenter, Windchill.Enovia, PDM resources on the Internet

10 HOURS

Module 5

PDM Implementation Case Studies: Sun Microsystems, Inc., Mentor Graphics Corporation, Ericsson Radio Systems AB, Ericsson Mobile Communications AB, ABB Automation Technology Products, SaabTech Electronics AB

12 HOURS

REFERENCE Books:

1. **Implementing and Integrating Product Data Management and Software Configuration Management** - 20 - IvicaCmkovic Ulf Asklund - AnnitaPerssonDahlqvist - Archtech HousePublishers.
2. **Product Data Management -** Rodger Burden - Publisher: Resource Publishing- ISBN-10: 0970035225, ISBN-13: 978-0970035226 – 2003.
3. **The AutoCAD Database Book – Accessing and Managing CAD Drawing Information**- Galgotia Publications - ThirdEdition.

ADVANCED MANUFACTURING PRACTICE

Subject Code : 16MPD242 **Exam Hours : 03**
CIE Marks : 40 **SEE Marks : 60**
No. of Lecture Hours/Week : 4 **Credits:4**
Total No. of Lecture Hours : 52

MODULE 1

Need of CPC for a company, what CPC can do, CPC-getting the right tool.
JIT – Introduction – The spread of JIT Movement, some definitions of JIT, core Japanese practices of JIT, Creating continuous Flow Manufacture, Enabling JIT to occur, Basic elements of JIT, Benefits of JIT.

Just in Time Production – Primary purpose, profit through cost reduction, Elimination of over production, Quality control, Quality Assurance, Respect for Humanity, Flexible work Force, JIT Production Adapting to changing production Quantities, process layout for shortened lead Times, Standardization of operation, Automation.

Sequence and Scheduling Used by Suppliers: Monthly and daily Information. Sequenced withdrawal system by sequenced schedule table, problems and counter measures in applying the Kanban system to sub contractors.

12 HOURS

MODULE 2

Toyota Production System-The philosophy of TPS, Basic Frame work of TPS, Kanbans.Determining the Number of Kanbans in Toyota Production System.

a) Kanban Number under Constant Quantity Withdrawal System.
b) Constant Cycle, Non-constant Quantity Withdrawal System.

Supplier Kanban and the Sequence Schedule for Use by Suppliers.

a) Later Replenishment System by Kanban.
b) Sequenced Withdrawal System.
c) Circulation of the Supplier Kanban within Toyota.

Production Smoothing in TPS, Production Planning, Production Smoothing,Adaptability to Demand Fluctuations
Sequencing Method for the Mixed Model Assembly Line to Realize Smoothed Production of Goal.

12 HOURS

MODULE 3

Just-in-Time Production with Total Quality Control just in time concept, cutting lot sizes, cutting set-up times, cutting purchase order costs, the JIT cause-Effect chain, Scrap/Quality Improvements, Motivational effects, Responsibility effects, small Group improvement Activities, withdrawal of Buffer Inventory, the total Quality Control Concept.

6 HOURS

MODULE 4

Total Quality Control-Introduction-Total Quality Control concepts, responsibility, learning from the west, TQC concepts categorized, Goals, Habit of improvement, perfection, Basics, process control, Easy to see Quality control as facilitator, small lot sizes, Housekeeping, Less than full capacity scheduling, Daily machine checking, Techniques and Aids, Exposure of problems, Fool proof Devices, Tools of Analysis, QC Circles, TQC in Japanese-owned US Electronics plant, TQC in Japanese-owned Automotive plants.

10 HOURS

MODULE 5

Plant Configurations: Introduction-ultimate lant configuration, job shop Fabrication, Frame Welding, Forming Frame parts from Tubing, Dedicated production lines, overlapped production, the daily schedule, Forward Linkage by means of Kanban, physical merger of processes, Adjacency, mixed Models, Automated production Lines, Pseudo Robots, Robots, CAD and Manufacturing, Conveyors and stacker Cranes, Automatic Quality Monitoring

10 HOURS

TEXT BOOKS:

1. **Japanese Manufacturing Techniques** - Richard Schonberger - Pearson Higher Education - ISBN:00292910031982
2. **Just In Time Manufacturing** – Kargoanker (manual).
3. **Wind-chill** reference manual.

REFERENCE BOOKS:

1. **An Integrated Approach To Just In Time** - Yasuhiro Monden - Toyota Production system.
2. **Lean Thinking** - James Womack - Simon & Schuster Adult - ISBN: 0743249275, 2003.
3. **The machine that changed the World** - James P. Womack, Daniel T Jones, and Daniel Roos - The story of Lean production – by– Harper Perennial edition published -1991.

NON-TRADITIONAL MACHINING PROCESS

Subject Code : 18MPD243 **Exam Hours : 03**
CIE Marks : 40 **SEE Marks : 60**
No. of Lecture Hours/Week : 4 **Credits:4**
Total No. of Lecture Hours : 50

Module 1

Introduction: Need for non-traditional machining processes.

Mechanical Process: Ultrasonic Machining-Definition-Mechanism of metal elements of the process- Tool feed mechanism. theories of mechanics of causing effect of parameter applications.

10 HOURS

Module 2

Abrasive Jet Machining: Principles - parameters of the process applications-advantages and advantages.

Thermal Metal Removal Process: Electric discharge machining Principle of operation – mechanism of meta removal basic EDM circuitry-spark erosion get Analysis of relaxation type of circuit material removal rate in relaxation.

10 HOURS

Module 3

Electro chemical and chemical processes: Electro chemical machining (ECM) Classification ECM process-principle of ECM Chemistry of the ECM parameters of the processes-determination of the metal removal rate - dynamics of ECM process-Hydrodynamics of ECM process-polarization-.Tool Design-advantages and disadvantages - applications. Electro Chemical Grinding-Electro Chemical holding Electrochemicaldeburring.

10 HOURS

Module 4

Chemical Machining: Introduction-fundamental principle types of chemical machining Maskants- Etchenes- Advantages and disadvantages-applications.

Plasma arc Machining: Introduction-Plasma-Generation of Plasma and equipment Mechanism of metals removal, PAN parameters-process characteristics - type of torches applications. **10 HOURS**

Module 5

Electron Beam Machining (EBM): Introduction-Equipment for production of Electron beam - Theory of electron beam machining Thermal & Non thermal types characteristics - applications.

Laser Beam Machining (LBM): Introduction-principle of generation of lasers Equipment and Machining procedure- Types of Lasers-Process characteristics-advantages and limitations-applications

Ion Beam Machining: Introduction-Mechanism of metal removal and associated equipment-process characteristics applications

10 HOURS

REFERENCE BOOKS:

1. **New technology Institution of Engineers** - Bhattacharya -India
2. **Production Technology** - HMT - Tata McGraw Hill - ISBN-10;0070964432
3. **Modern Machining Process** - P.C Pandy& H.S. Shan - Tata McGraw Hill - ISBN: 0070965536 - Publishing Date:Feb-80
4. **Metals Hand Book** - ASM -Vol-3.
5. **Modern Manufacturing Method** - Adithan- New Age International (p) Limited - ISBN**:** 8122408176,2007.
6. **Modern Machining Processes** - P.K. Mishra - Narosa Publishing House, New Delhi -1997.

QUALITY AND RELIABILITY ENGINEERING

Exam Hours : 03

Subject Code : 18 MPD251
CIE Marks : 40 **SEE Marks : 60**
No. of Lecture Hours/Week : 4 **Credits:4**
Total No. of Lecture Hours : 50

Module 1

Basic Concepts: Definitions of quality and Reliability, Parameters and Characteristics, Quality control, statistical Quality Control, Reliability concepts.
Concepts in Probability and Statistics : Events, Sample Space, Probability rules, Conditional probability, Dependent and Independent Events, Application of Probability concepts in Quality Control,Problems

10HOURS

Module 2

Introduction to Probability Distributions : Normal, Poisson and Binomial distribution.
Control Charts : Variable Chart – X Bar chart, R-chart and Sigma chart. Attribute Chart : P – Chart, nP Chart, C- Chart and U – Chart.

10HOURS

Module 3

Acceptance Sampling: Fundamentals of acceptance sampling, types of acceptance sampling, O.C Curve, AQL, LTPD, AOQL.
Failure Data Analysis : Introduction, Failure Data, Quantitative measures, MTTF, MTBF, Bathtub Curve, Mean Life, Life Testing, Problems, Introduction to Failure Mode and Effect Analysis.

10HOURS

Module 4

System Reliability: Series, parallel and mixed configuration, Block diagram concept, r- out-of-n structure solving problems using mathematical models.

Reliability Improvement and Allocation : Difficulty in achieving reliability, Methods for improving reliability during design, Different techniques available to improve reliability.

10HOURS

Module 5

Maintainability and Availability: Introduction, Formulas, Techniques available to improve maintainability and availability trade-off among reliability, maintainability and availability, Simple problems

10HOURS

REFERENCE BOOKS:

1. **Quality Planning and Analysis -** Tata McGraw - Juran, J.M and Gryna, F.M. - Hill publishing Coimpany Ltd., New Delhi, India –1982.
2. **Maintainability and Reliability Handbook of Reliability Engineering and Management -** Editors –Ireson. W.G. and Cooms- C.F. McGraw - Hill Book Company Inc. –1988.
3. **Concepts in Reliability Engineering-** Srinath L S - Affiliated East-West Press Private Limited, New Delhi, India. –1985.
4. **An Introduction to Reliability and Maintainability Engineering -** TMH Charles Ebeling - Tata Mcgraw Hill –2000.
5. **Reliability Engineering -** A K Govil - Prentice Hall –1981.

VIRTUAL DESIGN AND MANUFACTURING

Subject Code : 18MPD252 **Exam Hours : 03**
CIE Marks : 40 **SEE Marks : 60**
No. of Lecture Hours/Week : 4 **Credits:4**
Total No. of Lecture Hours : 50

Module 1

Review of Computer Graphics: Review of computer graphics, 2D graphics.2D primitives and transformations. Algorithm to digitize the graphic entities, rasterization, 3D graphics.3D primitives and transformations, projections and viewing, algorithms for hidden line removals, lighting.Shading and raytracing.

10 HOURS

Module 2

VR Devices: Input devices-track balls, 3D Mouse, data gloves, Virtual hand and trackers, output devices graph terminal, stereo glasses, head mounting devices, vision dome, caves.

10 HOURS

Module 3

Applications: Virtual prototyping, behavior simulation, digital mockup, walk through/flythrough. Virtual training/simulation, micro electro mechanical systems and nanotechnology.

10 HOURS

Module 4

Virtual Modeling language: History, Concepts, syntax, basic nodes-group, transform switch, LOD etc, geometry nodes-indexed face set, indexed line set, coordinate, coordindwx, textures etc. sensor nodes-time sensor touch sensor, sphere sensor, cylinder sensor and proximity sensor, scriping- VRML Script and JAVA Script.

10 HOURS

Module 5

Tutorials and samples: VRML authoring tools-3D studio MAX, cosmo World, VRML Pad (editor) VRML Viewing tools-cosmo player, auto Vue, SGI's open inventor, virtual collaborative tools.

10 HOURS

REFERENCE BOOKS:

1. **Computer Graphics-Principles and practice -** JanesD,Foley et al., - Second edition. inC,Addision -Wesley 1997.
2. **The VRML- 2.0 Hand book -** Jed Hartman and Josie wernecke - Addision-Wesley-1997.
3. **The Annocated VRML 2.0 hand book Addision -** R Carey and G Bell -Wesley1997.

LEAN MANUFACTURING SYSTEMS

Subject Code : 18MPD253 **Exam Hours : 03**
CIE Marks : 40 **SEE Marks : 60**
No. of Lecture Hours/Week : 4 **Credits:4**
Total No. of Lecture Hours :50

Module 1

Just in time production system. JIT Logic -Pull system Japanese approach to production elimination of waste - JIT implementation requirements JIT application for job shops, Case studies

10 HOURS

Module 2

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.

10 HOURS

Module 3

The rise of lean production: - Birth place, 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.

10 HOURS

Module 4

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 viz G M Framingharn: Toyota Takaoka Mass Production V /s lean production, diffusing lean production.

10 HOURS

Module 5

Managing lean enterprise:- Finance, Career ladders, geographic spread and advantages of global enterprise.

Prospects for catching up. Simplicity in the natural state: institutional factors -life time employment -educational commodities -quality & productivity in full circle.

10 HOURS

REFERENCE BOOKS:

1. **Productions and Operations Management** - ChaselAquilino - Dreamtech latestedition.
2. **Toyoto Production System -An integrated approach to Just in Time** - Yasuhiro Monden - Engineering aild Management Press -Institute of Industrial Engineers Norcross Georgia -1983.
3. **The Machine that changed the World. The Story of Lean Production -** James P Womack - Daniel TJones
   - and Daniel Roos -Harper Perennial - edition published 1991.
4. **Lean Thinking -** James Womack – ISBN 0743249275 –2003.
5. **Japanese Manufacturing Techniques. The Nine Hidden Lessons by simplicity** - Richard Schourberger - ASQC Press1991.
6. **Quality Function Development** - James Bossert - ASQC Press1991.

PRODUCT DESIGN LAB-2

Subject Code : 18 MPDL26 **Exam Hours : 03**
CIE Marks : 40 **SEE Marks : 60**
No. of Practical Hours/Week : 4 **Credits:2**
Total No. of Practical Hours : 52

General Guidelines:

StudentsneedtogeneratetheSolidModelandDraftttherequir
edviews.

1. The orthographic views and solution shall bedrawn.
2. Ifrequired,variousmanufacturingsequencesshallbeshowninthemodelanddrawing.
3. Any 3D Modeling and Drafting CAD tools arepermitted.
4. Dimensions that are not defined may beassumed.
5. Results,includingthecalculationsshallbeshownalongwiththedrawing.

No	Description	Suggested Books and references
1	The shaft assembly of the intermediate transmission unit shown in Fig.1.42 is required to have an axial freedom of maximum 0.18 mm and minimum 0.06 mm when assembled in working condition. Using the nominal sizes specified for the miter bevel gear, shaft, housing, bearing bushes and spur gear, shown in Fig. 1.43, draw only the relevant components and state only the appropriate limits to achieve the required axialfreedom.	Fig.1.42 and Fig.1.43 from the book "DESIGN FOR MANUFACTUR E" by Harry Peck.
2	The partial assembly of an oil pump is shown in Fig.1.45. A four lobe inner rotor is mounted off-set to the body bore in which a five lobe outer rotor rotates, driven by the innerrotor. Both the specified clearances are to be measured by a feeler gauge when the parts are assembled. Taking this procedure into account, and also the fact that the outer rotor can "float" radially, state the appropriate limits for the relevant dimensions which will ensure that the specified clearance limits are not exceeded. Assume zero clearance between inner rotor stem and body bore (20 mm diameter). Nominal sizes are shown inFig.1.46.	Fig.1.45 and Fig.1.46 from the book "DESIGN FOR MANUFACTUR E" by Harry Peck.
3	The shaft is to be manufactured from 0.4 % carbon steel to the sizes shown in Fig. 2.31. The 30 mm and the 25 mm diameter are to be ground. Prepare a production detail drawing for the shaft.	Fig.2.31 from the book "DESIGN FOR MANUFACTUR E" by Harry Peck.
4	The slide block shown in Fig.3.42 is to be manufactured in batches of 100. Describe a method of manufacture intended to reduce machining time to aminimum. Redraw the block showing the appropriate manufacturingdimensions.	Fig.3.42 from the book "DESIGN FOR MANUFACTUR E" by Harry Peck.

5	In the fulcrum block shown in Fig.4.39, a lever, mounted on a hinge pin, oscillates 30° each side of the vertical centre line; this lever is shown, chain dotted, in the two extremes of the position. Comment on the machining involved and show design modifications to facilitate the machining.	Fig.4.39 from the book "DESIGN FOR MANUFACTUR E" by Harry Peck.
6	st a suitable operation sequence for the stub carrier shown in Fig.4.40 and redraw the component incorporating features to facilitate manufacture. The carrier is to be produced from a steel casting and the symbol 'G' indicates a ground surface for the 30 mm diameter f8 limits.	Fig.4.40 from the book "DESIGN FOR MANUFACTUR E" by Harry Peck.
7	Indicate the parting line for the steel forked lever casting seen in Fig.5.27, and also the necessary sand cores. Maintaining as nearly as possible, the existing weight of the casting, offer a design modification that will alleviate the sand core requirements.	Fig.5.27 from the book "DESIGN FOR MANUFACTUR E" by Harry Peck.
8	For the pedestal shown inFig.5.28 indicate the probable parting line and any unnecessary sand cores, accepting that the probable parting line is the one involving the minimum sand cores. Show a design modification to reduce or eliminate the need for sand cores; maintain approximately same weight of casting in the modified design.	Fig.5.28 from the book "DESIGN FOR MANUFACTUR E" by Harry Peck.

SYLLABUS
III SEMESTER

PRODUCT ANALYSIS AND COST OPTIMIZATION

Subject Code : 18MPD31 **Exam Hours : 03**
CIE Marks : 40 **SEE Marks : 60**
No. of Lecture Hours/Week : 4 **Credits:4**
Total No. of Lecture Hours : 50

MODULE 1

Introduction: New products, new product strategy -market definition Idea generation introduction to the design process -forecasting sales potential -product engineering and markets-monopoly competitive.
Manufacturing Planning: Selection of optimum process, standardization. Break even analysis-application and area of use -problems -multi - product analysis.

10HOURS

MODULE 2

Value Analysis: Steps in selection, analysis and implementation, Selection of cutting speed for optimum cost -problems.
Cost Accounting: Cost estimation -difference -types -steps involved in cost estimation.

10 HOURS

MODULE 3

Types of Cost: Cost Centres, Direct –indirect, material cost -direct indirect material cost Overhead cost, Elements in overheads: Preparation of cost sheet, machine hour rate, apportioning methods

10 HOURS

MODULE 4

Variance Analysis – Labour variance, Material variance and Overhead variance**, A**ctivity based costing - Introduction to target costing.

10 HOURS

MODULE 5

Cost Calculation: Cost calculation for machined components, welding, casting and forged components illustrations -calculation of sales cost.
Cost Optimization Techniques: Analytical, Graphical and incremental methods Learning curves.

10 HOURS

TEXT BOOKS:

1. **Design and Marketing of New Products** - Glen L Urban - John R Hauser- Prentice Hall. New Jersey, 1980.
2. **Production and Costing** - Narang CBS & Kumar V - Khanna Publishers- 2001.

REFERENCE BOOKS:

1. **Cost management in the New Manufacturing Age** -Yasuhiro Monden, ProductivityPress-1992.
2. **Technique for Value Analysis And Engineering** - Miles Lewrence.D- McGraw Hill, New york-1972.

OPTIMISATION TECHNIQUES FOR DECISION MAKING

Subject Code : 18MPD321 **Exam Hours : 03**
CIE Marks : 40 **SEE Marks : 60**
No. of Lecture Hours/Week : 4 **Credits:4**
Total No. of Lecture Hours : 50

MODULE 1

Introduction: Engineering application of optimization, multivariable optimization Statement of a optimization problem. Design Vector, Design constraints, objective function, classification of optimization problems.

Classical Optimization Technique: Single variable optimization, with equality Constraints solution by direct substitution, solution by the method of constrained Variation. Solution by the method of Lagrange multipliers, multivariable optimization with inequality constraints Kuhn – Tucker condition.

10 HOURS

MODULE 2

Non-linear Programming: (One Dimensional minimization method) Numerical method, Unimodal function, Unrestricted search, Exhaustive search. Dichotomous search, Fibonacci and Golden section method.

10 HOURS

MODULE 3

Interpolation Method: Quadratic and Cubic Nonlinear programming (Unrestricted Optimization Technique) Random search methods, Univariate method, powels method, Simplex method.

10 HOURS

MODULE 4

Descent Methods: Steepest descent, conjugate gradient, variable metric method.

Non Linear Programming: (Constrained Optimization problem) Characteristic of a constrained problem.

10 HOURS

MODULE 5

Direct Methods: The complex method, cutting plane method, methods of Feasible directions.

Indirect Methods: Transformation technique, change variables and elimination of variables, penalty function methods- interior and exterior penalty function.

10 HOURS

TEXT BOOKS:

1. **Optimization, "Theory and Application" -** S.S. Rao - Willey Eastern - 1984

REFERENCE BOOKS:

1. **Optimization methods for Engg. Design -** R.L Fox - Addison – Wesley – ISBN 0201020785 - 1971
1. **Optimisation Theory and Practice** - GSG Beveridge and R.S. Schechter - McGraw Hill, New York – 1970.
2. **Optimisation and Probability in System Engg**.- Ram - Van Nostrand – 1974.

RAPIDPROTOTYPING

Subject Code : 18MPD222 **Exam Hours : 03**
CIE Marks : 40 **SEE Marks : 60**
No. of Lecture Hours/Week : 4 **Credits:4**
Total No. of Lecture Hours : 50

Module 1

Introduction: Need for the compression in product development, history of RP systems, Survey of applications, Growth of RP industry, and classification of RP systems.

Stereo Lithography Systems: Principle, Process parameter, Process details, Data preparation, data files and machine details, Application.

10 HOURS

Module 2

Selective Laser Sintering and Fusion Deposition Modeling: Type of machine, Principle of operation, process parameters, Data preparation for SLS, Applications, Principle of Fusion deposition modeling, Process parameter, Path generation, Applications

10 HOURS

Module 3

Solid Ground Curing: Principle of operation, Machine details, Applications.

Laminated Object Manufacturing: Principle of operation, LOM materials. Process details, application.

10 HOURS

Module 4

Rapid Tooling: Indirect Rapid tooling -Silicone rubber tooling –Aluminum filled epoxy tooling Spray metal tooling, Cast kirksite, 3Q keltool, Direct Rapid Tooling Direct. AIM, Quick cast process, Copper polyamide, Rapid Tool, DMILS, Prometal, Sand casting tooling, Laminate tooling soft Tooling vs. hard tooling.

10 HOURS

Module 5

RP Process Optimization: factors influencing accuracy. Data preparation errors, Part building errors, Error in finishing, influence of build orientation.

10 HOURS

REFERENCE BOOKS:

1. **Stereo lithography and other RP & M Technologies** -Paul F. Jacobs - SME, NY1996.
2. **Rapid Manufacturing -** Flham D.T &Dinjoy S.S - Verlog London2001.
3. **Rapid automated -** Lament wood - Indus press NewYork
4. **Wohler's Report 2000 -** Terry Wohlers - Wohler's Association -2000

VALUE ENGINEERING

Subject Code : **18MPD323** **Exam Hours : 03**
CIE Marks : 40 **SEE Marks : 60**
No. of Lecture Hours/Week : 4 **Credits:4**
Total No. of Lecture Hours : 50

MODULE 1

INTRODUCTION TO VALUE ANALYSIS: Definition of Value, Value Analysis, Value Engineering, Value management, Value Analysis versus Value Engineering, Value Analysis versus Traditional cost reduction techniques, Symptoms to apply value analysis, Coaching of Champion concept.

TYPE OF VALUES: Reasons for unnecessary cost of product, Peeling cost Onion concept, unsuspected areas responsible for higher cost, Value Analysis Zone, attractive features of value analysis. Meaning of Value, types of value & their effect in cost reduction.

10 HOURS

MODULE 2

FUNCTIONAL COST AND ITS EVALUATION: Meaning of Function and Functional cost, Rules for functional definition, Types of functions, primary and secondary functions using verb and Noun, Function evaluation process, Methods of function evaluation. Evaluation of function by comparison, Evaluation of Interacting functions, Evaluation of function from available data, matrix technique, MISS technique, Numerical evaluation of functional relationships and case studies.

PROBLEM SETTING & SOLVING SYSTEM: A problem solvable stated is half solved, Steps in problem setting system, Identification, Separation and Grouping of functions. Case studies.

10 HOURS

MODULE 3

VALUE ENGINEERING JOB PLAN: Meaning and Importance of Value Engineering Job plan. Phases of job plan proposed by different value engineering experts, Information phase, Analysis phase, Creative phase, Judgement phase, Development planning phase, and case studies. Cost reduction programs, criteria for cost reduction program, Value analysis change proposal.

10 HOURS

MODULE 4

VALUE ENGINEERING TECHNIQUES: Result Accelerators or New Value Engineering Techniques, Listing, Role of techniques in Value Engineering, Details with Case examples for each of the Techniques.

ADVANCED VALUE ANALYSIS TECHNIQUES: Functional analysis system technique and case studies, Value analysis of Management practice (VAMP), steps involved in VAMP, application of VAMP to Government, University, College, Hospitals, School Problems etc., (service type problems).

10 HOURS

MODULE 5

APPLICATION OF VALUE ANALYSIS: Application of Value analysis in the field of Accounting, Appearance Design, Cost reduction, Engineering, manufacturing, Management, Purchasing, Quality Control, Sales, marketing, Material Management Etc., Comparison of approach of Value analysis & other management techniques.

10 HOURS

TEXT BOOKS:

Techniques of Value Analysis and Engineering– Lawrence D. Miles, McGraw – Hill Book Company, 2ndEdn.

Value engineering for Cost Reduction and Product Improvement – M.S. Vittal, Systems Consultancy Services Edn 1993

Value Management, Value Engineering and Cost Reduction – Edward D Heller Addison Wesley Publishing Company 1971

REFERENCE BOOKS:

Value Analysis for Better Management – Warren J Ridge American Management Association Edn 1969

Getting More at Less Cost (The Value Engineering Way) – G.Jagannathan Tata Mcgraw Hill Pub. Comp. Edn 1995

Value Engineering – Arther E Mudge McGraw Hill Book Comp. Edn 1981

ROBUST DESIGN

Subject Code :18MPD331IA Marks : 50
No. of Lecture Hours/Week : 04 Exam Hours : 03
Total No. of Lecture Hours : 52 Exam Marks : 100

MODULE - 1

Quality by Experimental Design : Quality, western and Taguchi quality philosophy, Elements of cost, Noise factors causes of variation, Quadratic loss function and variation of quadratic loss functions.

Robust Design : Steps in robust design : parameter design and tolerance design, reliability improvement through experiments, illustration through numerical examples.

12 HOURS

MODULE - 2

Experimental Design: Classical experiments: factorial experiments, terminology, factors. Levels, Interactions, Treatment combination, randomization, 2-level experimental design for two factors and three factors. 3-level experiment deigns for two factors and three factors, factor effects, factor interactions, Fractional factorial design, Saturated design, Central composite designs, Illustration through numerical examples**.**

10 HOURS

MODULE - 3

Measures of Variability : Measures of variability, Concept of confidence level, Statistical distributions : normal, log normal and Weibull distributions. Hipothesis testing, Probability plots, choice of sample size illustration through numerical examples.

Analysis and interpretation of experimental data: Measures of variability, Ranking method, column effect method and ploting method, Analysis of variance (ANOVA), in factorial experiments : YATE's algorithm for ANOVA,Regression analysis, Mathematical models from experimental data, illustration through numerical examples.

08 HOURS

MODULE - 4

Taguchi's Orthogonal Arrays : Types orthogonal arrays, Selection of standard orthogonal arrays, Linear graphs and interaction assignment, dummy level technique, Compound factor method, modification of linear graphs, Column merging method, Branching design, Strategies for constructing orthogonal arrays.

Signal to Noise ratio (S-N Ratios) : Evaluation of sensitivity to noise, Signal to noise ratios for static problems, Smaller – the – better types, Nominal – the – better – type, larger – the- better – type. Signal to noise ratios for dynamic problems, Illustrations through numerical examples.

10 HOURS

MODULE - 5

Parameter Design and Tolerance Design : Parameter and tolerance design concepts, Taguchi's inner and outer arrays, Parameter design strategy, Tolerance deign strategy, Illustrations through numerical examples**.**

Reliability Improvement Through Robust Design : Role of S-N ratios in reliability improvement ; Case study; Illustrating the reliability improvement of routing process of a printed wiring boards using robust design concepts.

10 HOURS

TEXT BOOKS:

1. **Quality Engineering using Robust Design -** Madhav S. Phadake: Prentice Hall, Englewood Clifts, New Jersey 07632, 1989.
2. **Design and analysis of experiments -** Douglas Montgomery: Willey India Pvt. Ltd., V Ed., 2007.
3. **Techniques for Quality Engineering -** Phillip J. Ross: Taguchi 2nd edition. McGraw Hill Int. Ed., 1996.

REFERENCE BOOKS:

1. **Quality by Experimental Design -** Thomas B. Barker - Marcel Dekker Inc ASQC Quality Press, 1985
2. **Experiments planning, analysis and parameter design optimization -** C.F. Jeff Wu, Michael Hamada - John Willey Ed., 2002.
3. **Reliability improvement by Experiments -** W.L. Condra, - Marcel Dekker Inc ASQC Quality Press, 1985

SIMULATION AND MODELING OF MANUFACTURING SYSTEMS

Subject Code : 18MPD332 **Exam Hours : 03**
CIE Marks : 40 **SEE Marks : 60**
No. of Lecture Hours/Week : 4 **Credits:4**
Total No. of Lecture Hours : 50

Module - 1

Principles of Computer Modeling And Simulation: Monte Carlo simulation. Nature of computer- modeling and simulation. Limitations of simulation, areas of applications.
System and Environment: Components of a system -discrete and continuous systems, Models of a system -a variety of modeling approaches.

10 HOURS

Module -2

Discrete Event Simulation: Concepts in discrete event simulation, manual simulation using event scheduling, single channel queue, two server queue, simulation of inventory problem.

10 HOURS

Module -3

Random Number Generation: Techniques for generating random numbers- Mid square method -the mod product method -Constant multiplier technique -Additive congruential method -Linear congruential method -Tests for random numbers -The Kolmogorov-Smirnov test -the Chi-square test.

10 HOURS

Module -4

Random Variable Generation: Inversion transforms technique-exponential distribution. uniform distribution, weibul distribution, continuous distribution, generating approximate normal variates-Erlang distribution.

10 HOURS

Module -5

Input modeling, verification and validation of simulation models: Goodness of fit test, chi square test, steps in verification and validation of simulation modeling's, simple problems **.**
Simulation Software: Selection of simulation software, simulation packages.

10 HOURS

REFERENCE BOOKS :

1. **Discrete Event System Simulation** - Jerry Banks & .John S Carson II - Prentice Hall Inc.- 1984.
2. **Systems Simulation** - Gordan. G - Prentice Hall India Ltd -1991.
3. **System Simulation With Digital Computer** - NusingDeo - Prentice Hall of India - 1979.
4. **Computer Simulation and Modeling** - Francis Neelamkovil - John Wilely& Sons -1987.
5. **Simulation Modeling with Pascal -** RathM.Davis& Robert M O Keefe - Prentice Hall Inc. – 1989.

COMPUTER APPLICATIONS IN DESIGN

Subject Code : 18MPD333 **Exam Hours : 03**
CIE Marks : 40 **SEE Marks : 60**
No. of Lecture Hours/Week : 4 **Credits:4**
Total No. of Lecture Hours : 50

Module -1

Introduction to CAD/CAM/CAE Systems: Overview, Definitions of CAD. CAM and CAE, Integrating the Design and Manufacturing Processes through a Common Database-A Scenario, Using CAD/CAM/CAE Systems for Product Development

Components of CAD/CAM/CAE Systems: : Hardware Components ,Vector-Refresh (Stroke-Refresh) Graphics Devices, Raster Graphics Devices, Hardware configuration, Software Components.

10HOURS

Module -2

Basic Concepts of Graphics Programming: Graphics Libraries, Coordinate Systems, Window and Viewport, Output Primitives - Line, Polygon, Marker Text, Graphics Input, Display List, Transformation Matrix, Translation, Rotation, Mapping, Other Transformation Matrices, Hidden-Line and Hidden-Surface Removal, Back-Face Removal Algorithm, Depth-Sorting, or Painter.s, Algorithm, Hidden- Line Removal Algorithm, z-Buffer Method, Rendering, Shading, Ray Tracing, Graphical User Interface, X Window System.

10 HOURS

Module -3

Representation and Manipulation of Curves: Types of Curve Equations, Conic Sections, Circle or Circular Arc, Ellipse or Elliptic Arc, Hyperbola, Parabola, Hermite Curves, Bezier Curve, Differentiation of a Bezier Curve Equation, Evaluation of a Bezier Curve, B-Spline Curve, Evaluation of a B-Spline Curve, Composition of B-Spline Curves, Differentiation of a B-Spline Curve, Non-uniform Rational B-Spline (NURBS) Curve.

Representation and Manipulation of Surfaces: Types of Surface Equations, Bilinear Surface, Coon's Patch, Bicubic Patch, Bezier Surface, Evaluation of a Bezier Surface,

10 HOURS

Module -4

CAD and CAM Integration : Overview of the Discrete Part Production Cycle, Process Planning, Manual Approach, Variant Approach, Generative Approach, Computer-Aided Process Planning Systems, CAM-I CAPP, MIPLAN and Multi CAPP, Met CAPP, ICEM-PART, Group Technology, Classification and Coding, Existing Coding Systems, Product Data Management (PDM) Systems.

10HOURS

Module -5

Standards for Communicating Between Systems: Exchange Methods of Product Definition Data, Initial Graphics Exchange Specification, Drawing Interchange Format, Standard for the Exchange of Product Data. Tutorials, Computational exercises involving Geometric Modeling of components and their assemblies

10 HOURS

Text Book:

1 **Principles of CAD/CAM/CAE systems** – Kunwoo - Lee Addison Wesley -1999

2. **CAD/CAM/CIM** - Radhakrishnan P. et al. - New Age International - 2008

Reference Books:

1. **CAD/CAM – Theory & Practice -** Ibrahim Zeid - McGraw Hill - 1998

2. **Computer Integrated Design and Manufacturing -** Bedworth, Mark Henderson & Philip Wolfe - McGraw hill inc. - 1991.

3. **Part modeling Users Guide -** Pro-Engineer - 1998