VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM
SCHEME OF TEACHING AND EXAMINATION FOR
M.TECH.-PRODUCT DESIGN AND MANUFACTURING ENGINEERING (MPD)

I Semester   **CREDIT**
BASED

Subject Code	Name of the Subject	Teaching hours/week		Duration of Exam in Hours	Marks for		Total Marks	CREDITS
		Lecture	Practical / Field Work / Assignment/ Tutorials		I.A.	Exam		
16 MPD 11	Product Design and Development	4	-	3	20	80	100	4
16 MPD12	Product Life Cycle Management	4	-	3	20	80	100	4
16 MPD13	Advanced Materials Technology	4	-	3	20	80	100	4
16 MPD 14	Finite Element Methods	4	-	3	20	80	100	4
16 MPD 15x	Elective - I	3	-	3	20	80	100	3
16 MPD16	Lab Component	--	3	3	20	80	100	2
16MPD17	Seminar	--	3	--	100	--	100	1
	Total	**19**	**6**	**18**	**220**	**480**	**700**	**22**

Elective – I	
Sub. Code	Name of the Subject
16MPD 151	Applied Probability & Statistics
16MPD 152	Simulation and Modeling of Manufacturing Systems
16MPD 153	Computer Applications in Design
16MPD 154	Quality by Design

I SEMESTER
PRODUCT DESIGN AND DEVELOPMENT

Subject Code :16MPD11   **IA Marks : 20**
No. of Lecture Hours/Week : 04   **Exam Hours : 03**
Total No. of Lecture Hours : 50Exam Marks : 80

Module -1

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

Development Processes and Organizations: A generic development process, conceptdevelopment: the front-endprocess, adopting the generic product development process, the AMF development process, product developmentorganizations, the AMF organization.

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

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 theprocess.

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

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

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.

Module -4

INDUSTRIAL DESIGN: Assessing the need for industrial design, the impact of industrial design, industrial designprocess, 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.

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, projectexecution, postmortem project evaluation.

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

PRODUCT LIFE CYCLE MANAGEMENT
Subject Code:16MPD12IA Marks : 20
No. of Lecture Hours/Week : 04 Exam Hours : 03
Total No. of Lecture Hours : 50Exam Marks : 80
Module -1

Product life cycle management – Need for PLM, Components of PLM, Product Data and Product workflow, Driversfor Change,The PLM Strategy, Developing a PLM Strategy, A Five-step Process

Module -2

Strategy Identification and Selection, Strategy Elements, Implications of Strategy Elements, Policies, StrategyAnalysis, Communicating the Strategy, Change Management for PLM, Configuration management, cost of design changes, schemes for concurrentengineering,

Module -3

Opportunities of a growing market, Technology opportunities, smart product opportunity, opportunity of global products, social and environmental opportunities for products, opportunities to detailed benefits.

Module -4
Facilities and Equipments, characteristics, organization, characteristics, changing environment and organization, challenges.

Module -5
PLM Applications, overview, issues, grouping, Generic and specific PLM applications, task specific applications, applications and data management, database and data management, data models and challenges.

REFERENCE BOOKS:

1. **Product Lifecycle Management Paradigm for century Product Realization -** John Stark,
2.**Product Lifecycle Management: Driving the Next Generation of Lean Thinking** by Michael Grieves, McGraw-Hill Education;
1 edition (November 16, 2005), ISBN-10: 0071452303, ISBN-13: 978-0071452304

3. **Product Lifecycle Management by AnttiSaaksvuori**- 3rd edition, Springer; 3rd edition (May 9, 2008), ISBN-10: 3540781730, ISBN-13: 978-3540781738

ADVANCED MATERIALS TECHNOLOGY

Subject Code :16MPD13 IA Marks : 20
No. of Lecture Hours/Week : 04 Exam Hours : 03
Total No. of Lecture Hours : 50 Exam Marks : 80

Module -1

Introduction to composite materials
Definition, Classification, Types of matrices & reinforcements, characteristics &selection, Fiber composites,laminated composites, particulate composites, prepregs, sandwich construction.

Micro mechanical analysis of a lamina
Introduction, Evaluation of the four elastic moduli – Rule of mixture, ultimate strengths of unidirectional lamina.

Module -2

Macro mechanics of a lamina:
Hooke's law for different types of materials, number of elastic constants, Two – dimensional relationship ofcompliance & stiffness matrix. Hooke's law for two dimensional angle lamina, engineering constants – angle lamina,Invariants, Theories of failure.

Module -3

Macro Mechanical analysis of laminate:
Introduction, code, Kirchoff hypothesis – CLT, A, B, & D matrices, Engineering constants, Special cases of laminates,Failure criterion.

Module -4

Manufacturing:

Layup and curing – open and closed mould processing – Hand lay –up techniques – Bag moulding and filamentwinding. Pultrusion, pulforming, Thermoforming, Injection moulding, Quality assurance – Introduction, material qualification, types of defects, NDT methods.

Module -5

Application developments - aircrafts, missiles, space hardware, automobile, electrical and electronics, marine,recreational and sports equipment-future potential of composites.

Metal matrix composites: Reinforcement materials, types, Characteristics & selection, base metals- selection,applications.

Text Books:
1. **Composite Materials handbook** - Mein Schwartz - McGraw Hill Book Company - 1984.
2. **Mechanics of composite materials -** Autar K. - Kaw CRC Press New York. –1st edition, 1997.

Reference Books:
1. **Mechanics of composite materials** - Rober M. Joness - McGraw Hill KogakushaLtd. – 2008.
2. **Stress analysis of fiber Reinforced composite materials -** Michael W Hyer - McGraw Hill International -1999.
3. **Composite material science and Engineering** - Krishan K - Chawla Springer - 1999.
4. **Fibre reinforced composites -** P.C. Mallik Marcel Decker- 2nd edition, New York -1993.

FINITE ELEMENT METHODS
Subject Code :16MPD14IA Marks : 20
No. of Lecture Hours/Week : 04 Exam Hours : 03
Total No. of Lecture Hours : 50Exam Marks : 80
Module -1

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

FEM for 1-D Problems: General procedure for FEA, Raleigh Ritz method, Galerkin Approach, shape functions,stiffness matrix, load vectors, temperature effects, Applications of boundary conditions using elimination and penaltyapproaches, Application problems – 1-D bar element. Trusses and beams

Module -2

FEM for 2-D Problems: Shape functions, stiffness matrix, strain matrix, load vectors for CST Elements andapplication problems

Module -3

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

Module -4

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

Module -5

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

REFERENCE BOOKS:

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

2. **Concepts and Applications of finite Element Analysis** - Cook R.D - Malkus D.S &Plesha
M.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 - 2nd
Edition, 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.

APPLIED PROBABILITY AND STATISTICS
Subject Code :16MPD151 IA Marks : 20
No. of Lecture Hours/Week : 03Exam Hours : 03
Total No. of Lecture Hours : 40Exam Marks : 80

Module -1

Introduction to statistics: Statistical Thinking, Collecting data, Statistical Modeling Frame work, measure of centraltendency and variance, Importance of Data summary and Display, Tabular and Graphical display.

Module -2

Discrete Random Variables and Probability distribution: Discrete Random variables, Probability distributions andProbability mass functions, Cumulative distribution functions, Mean and Variance of a discrete random variable,discrete uniform distribution, Binominal distribution, Hyper Geometric distribution, Poisson distribution,Applications.

Module -3

Continuous Random Variables and Probability Distributions: Continuous random variables, Probabilitydistributions and probability density functions, cumulative distribution functions, Mean and Variance of a continuousrandom variable, uniform distribution, Normal distribution, Normal approximation to Binominal and Poissondistribution, Exponential distribution.

Module -4

Testing of Hypothesis: Estimation theory, Hypothesis testing, Inference on the mean of a population (variance knownand unknown), Inference on the variance of a normal population, Inference on a population proportion, Testing forGoodness of Fit, Inference for a difference in Means, Variances known, Inference for a difference in means of twonormal distributions, Variances unknown, Inference on the Variances of two normal populations, Inference on two
population proportions.

Module -5

Simple Linear Regressions and Correlation: Simple Linear Regression, Properties of Least square Estimators andEstimation of variances, Transformations to a straight line, Correlation.
Multiple linear regressions model, least square estimation of parameters, Matrix approach to multiple linearregression, properties of least square estimators and estimation of variance.

REFERENCE BOOKS:
1 **Applied statistics and Probability for Engineers** – Douglas C Montgomery - George C
Runger– JohnWiley and Sons - 2nd Edn, ISBN-0-471-17027-5.- 2000.
2 **Statistics for Management** - Richard I Levin - David S Rubin - Prentice Hall India - 6th Edn,
ISBN-81-203-0893-X.- 1979.
3 **Probability and Statistics in Engineering** - William W Hines - Douglas C Montgomery –

John Wiley andSons - 2nd Edn, ISBN**:** 0471240877.
4 **Business Statistics for Management and Economics** - Daniel, Terrell - Houghton Mifflin
Company - 6^(th)Edn, ISBN-0-395-62835-0.
5 **Probability and Statistics** - Walpole & Mayer - MacMillan Publishing Company -1989.

SIMULATION AND MODELING OF MANUFACTURING SYSTEMS
Subject Code :16MPD152IA Marks : 20
No. of Lecture Hours/Week : 03Exam Hours : 03
Total No. of Lecture Hours :40Exam Marks : 80
Module - 1

Principles of Computer Modelling And Simulation: Monte Carlo simulation. Nature of computer- modeling andsimulation. Limitations of simulation, areas of applications.

System and Environment: Components of a system -discrete and continuous systems, Models of a system -a varietyof modeling approaches.

Module -2
Discrete Event Simulation: Concepts in discrete event simulation, manual simulation using event scheduling, singlechannel queue, two server queue , simulation of inventory problem.

Module -3
Random Number Generation: Techniques for generating random numbers- Mid square method -the mod productmethod -Constant multiplier technique -Additive congruential method -Linear congruential method -Tests for randomnumbers -The Kolmogorov-Smirnov test -the Chi-square test.

Module -4
Random Variable Generation: Inversion transforms technique-exponential distribution. uniform distribution, weibuldistribution, continuous distribution, generating approximate normal variates-Erlang distribution.

Module -5

Input modeling, verificationand 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.

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 :16MPD153 IA Marks : 20
No. of Lecture Hours/Week : 03Exam Hours : 03
Total No. of Lecture Hours :40Exam Marks : 80
Module -1
Introduction to CAD/CAM/CAE Systems: Overview, Definitions of CAD. CAM and CAE, Integrating the Designand Manufacturing Processes through a Common Database-A Scenario, Using CAD/CAM/CAE Systems for ProductDevelopment
Components of CAD/CAM/CAE Systems: : Hardware Components ,Vector-Refresh (Stroke- Refresh) GraphicsDevices, Raster Graphics Devices, Hardware configuration, Software Components.
Module -2

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

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 CurveEquation, Evaluation of a Bezier Curve, B-Spline Curve, Evaluation of a B-Spline Curve, Composition of B-SplineCurves, Differentiation of a B-Spline Curve, Nonuniform Rational B-Spline (NURBS) Curve.

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

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 andMulti CAPP, Met CAPP, ICEM-PART, Group Technology, Classification and Coding, Existing Coding Systems,Product Data Management (PDM) Systems.

Module -5

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

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

QUALITY BY DESIGN
Subject Code :16MPD154 IA Marks : 20
No. of Lecture Hours/Week : 03 Exam Hours : 03
Total No. of Lecture Hours :40Exam Marks : 80
Module -1

Define customer needs - Quality Function Deployment, Concept generation as System Technique (FAST), Use brainstorming and selection processes,

Module -2

Six Phases: Accept reduction phase. Review functional requirements, productspecifications, concepts, Select candidate. Concept evaluation phase, Pugh method, and technical risks, output,Conclusions and recommendations.

Module -3

Reliability design, Critical parameter management;

Module -4

Value engineering, Failure-analysis (FMEA). Prototype buildingand testing, Pre-production model and testing, Taguchi method,

Module -5

Statistical process control, product developmentcycle.

TEXT BOOKS:

1. **Quality Through design –** McGraw hill -1993.

2. **Engineering Quality by Design** Marcel Dekker Inc- New York. ISBN 0-8247-8246-1

REFERENCE BOOKS:

1. **Velocity Function Deployment -** Marcel Dekker Inc-New York.First Indian Edition 2005.

2. Techniques for value analysis and Engineering, 1972.

3. Management for quality improvement, productivity press.

4. Design, addition -Wesley, wokingham, 1991.

5. **Designing For Quality -** Matar - chapman & hall. New York –1990.

6. Indolence through quality and reliability, applied 1989.

7. **Design for excellence -** McGraw -Hill Inc, New York - 1996.

Laboratory Exercises
16 MPD 16

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 Axisymmetric problems

5. Transient Heat Transfer Analysis of 1D problems

6. Transient Heat Transfer Analysis of 2D problems

7. Heat Transfer Analysis of Axisymmetric 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