

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM
SCHEME OF TEACHING AND EXAMINATION FOR
M.TECH.-PRODUCTION ENGINEERING & SYSTEM TECHNOLOGY (MPT)

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 MPT 11	Quality & Reliability Engineering	4	-	3	20	80	100	4
16 MPT 12	Quantitative Techniques in Decision Making	4	-	3	20	80	100	4
16 MPT 13	Operations Management	4	-	3	20	80	100	4
16 MPT 14	Computer Integrated Manufacturing & Automation	4	-	3	20	80	100	4
16 MPT 15x	Elective - I	3	-	3	20	80	100	3
16MPT16	Lab Component	--	3	3	20	80	100	2
16MPT17	Seminar	--	3	--	100	--	100	1
Total		19	06	18	220	480	700	22

Elective – I

Sub. Code	Name of the Subject
16 MPT 151	Applied Probability and Statistics
16 MPT 152	Composite Materials
16 MPT 153	Theory of Metal Cutting
16 MPT 154	Advanced Materials & Processing

QUALITY AND RELIABILITY ENGINEERING

Sub Code	: 16 MPT 11	IA Marks	: 20
No. of Lecture Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 50	Exam Marks	: 80

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 10 HRS

MODULE 2

Statistical Aspects and Probability Distributions : Statistical Tools in Quality Control, The concept of Variation, Graphical Tools for data representation and analysis, Discrete and Continuous Distributions, Normal, Poisson, Binomial, Weibull Distribution, Problems, Control charts, Variable charts X chart, R chart, $\bar{\sigma}$ chart, Attribute charts, – P chart, NP chart, C chart. 10 HRS

MODULE 3

Failure Data Analysis : Introduction, Failure Data, Quantitative measures, MTTF, MTBF, Bathtub Curve, Mean Life, Life Testing, Problems, Introduction to Failure Mode and Effect Analysis.

Acceptance Sampling: Fundamentals of acceptance sampling, types of acceptance sampling, O.C Curve, AQL, LTPD, AOQL. 10 HRS

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, Optimization, Reliability-Cost trade off, Prediction and Analysis, Problems 10 HRS.

MODULE 5

Maintainability and Availability: Introduction, Formulas, Techniques available to improve maintainability and availability trade-off among reliability, maintainability and availability, Simple problems 10HRS

REFERENCE BOOKS:

1. **The Assurances Sciences** - Halpern, Seigmund - Prentice Hall International, New Jersey, U.S.A - 1978.
2. **Quality Planning and Analysis** - Juran, J.M and Gryna, F.M. - Tata McGraw Hill publishing Coimpany Ltd., New Delhi, India – 1982.
3. **Logistics Engineering and Management** - Blanchard, Bejamin S. - Prentice Hall International, New Jersey, U.S.A – 1986.
4. **Maintainability and Reliability Handbook of Reliability Engineering and Management** - Kraus, John W - Editors – Ireson. W.G. and Cooms, C.F. - McGraw Hill Book Company Inc. U.S.A – 1988.
5. **Concepts in Reliability Engineering** - Srinathm K.S. - Affiliated East-West Press Private Limited, New Delhi, India -1985.

QUANTITATIVE TECHNIQUES IN DECISION MAKING

Sub Code	16MPT 12	A Marks	20
No. of Lecture Hrs/week	04	Exam Hours	03
Total Lecture Hrs	52	Exam Marks	80

MODULE 1

Introduction: Statistics and managerial decisions, statistical data and Operations Research techniques.

Fundamentals of Statistics, probability and probability distributions: Measures of central tendency and location, Measure of dispersion, skewness and kurtosis, Probability and rules of probability, Random variables and probability distributions - Binomial, Poisson, Hyper geometric and Normal. 10 HRS

MODULE 2

Decision Making under Uncertainty: Alternative criteria for decision under uncertainty, Bayesian approach and Incremental analysis.

Linear Programming Problem: Formulation of L.P.P., Solution of L.P.P. by graphical method, Solution of L.P.P. by simplex method, Concept of duality and solution of dual problems, Solution of L.P.P. by dual simplex method and Sensitivity analysis. 10 HRS

MODULE 3

Transportation and Assignment Problems: Structure of transportation problem and various methods to find LB.F.S., Optimality test of transportation problems by MODI method, Solution of degeneracy and unbalanced transportation problems, Assignment problems and solution by Hungarian method and Traveling Salesman problem. 10 HRS

MODULE 4

Theory of Games: Two person zero sum game, Minimax & maximin strategies, Solution of game by dominance rules, arithmetic and algebraic methods, Solution of game by graphical method and method of matrices, Solution of game by Linear programming approach and approximate method to solve game problems. 10 HRS

MODULE 5

Network Analysis: PERT and CPM, Network construction and determination of critical path, Calculation of ES, EF, LS, LF, TF, FF and IF, Crashing of a project, Scheduling of a project and resource leveling.

Waiting Line: Basic structure of queuing systems and characteristics, Expressions for M/M/1 queuing model.

Simulation of Management systems: Simulation and Monte Carlo method, Waiting line and inventory simulation models 10 HRS

Text Books:

1. **Quantitative Techniques for managerial decisionsm** - Srivastava U.K. - New Age International Private Limited - ISBN Number: 8122401899.
2. **Operations Research** - H. Taha - Prentice Hall India – 8 Edition.

REFERENCE BOOKS:

1. **Operations Research: An Introduction** - Gupta and Heera - S.Chand and Company - 2002
2. **Introduction to Operations Research** - Hillier and Liberman - McGraw Hill International. - ISBN 10: 0072321695

OPERATIONS MANAGEMENT

Sub Code : 16MPT13
No. of Lecture Hrs/week : 04
Total Lecture Hours : 50

IA Marks : 20
Exam Hours : 03
Exam Marks : 80

MODULE 1

Understanding Operations: Introduction to operations management, manufacturing trends in India, Service as a part of operations management, operations as a key functional area, operations management: a systems perspective, operations management functions, challenges in operations management. **Operational strategy:** relevance of operations strategy, strategy formulation process, measure for operational excellence, options for strategic decisions in operations, break even analysis, cost versus flexibility trade off in operations strategy, related problems. 10 HRS

MODULE 2

Process and capacity analysis: process flow charting, planning premises and process implications, analyzing processes, business process Re Engineering, defining capacity, measure of capacity, time horizon in capacity planning, capacity planning framework, alternatives for capacity augmentation, decision tree for capacity planning, related problems.

Design of manufacturing process: Determinant of process characteristics in operations, types of process and operations systems, process product matrix, layout planning, types of layouts, performance measure for layout design, design of process layouts, design of product layouts, approaches to layout design, technology issues in process design, complexity in operations management, related problems. 10 HRS

MODULE 3

Inventory planning and control: inventory planning for independent demand items, types of inventory, cost of inventory, inventory control for deterministic demand items, handling uncertainty in demand, inventory control systems, selective control of inventory, inventory planning for single period demand, related problems. 10 HRS

MODULE 4

Demand forecasting: forecasting time horizon, design of forecasting system, developing forecasting logic, sources of data, and models for forecasting, extrapolative methods using time series, causal methods of forecasting, accuracy of forecasts, using forecasting system, related problems.

Aggregate production planning: planning hierarchies in operations, aggregate production planning, need, frame work for aggregate planning, alternatives for managing supply, basic strategies for aggregate production planning, aggregate production planning methods, OR tools for production planning, Master production scheduling, related problems. 10 HRS

MODULE 5

Resource planning: Dependent demand attributes, planning a framework, MRP Logic, MRP system, CRP, DRP, MRP II, ERP, Resources planning in services, related problems.

Scheduling of operations: need for scheduling, loading of machines, scheduling context, scheduling flow shops, scheduling of job shops, input output control, operational control issues in mass production systems, operations planning and control based on the theory of constrains, related problems.

Reference Books:

- **Operations Management: Theory and Practice,- B. MAHADEVAN**, Pearson Education India, 2010, ISBN 8131730700, 9788131730706

- Production And Operations Management: Edition 3 **R. PANNEERSELVAM**- PHI Learning Pvt, Ltd-

COMPUTER INTEGRATED MANUFACTURING & AUTOMATION

Sub Code	: 16 MPT 14	IA Marks	: 20
No. of Lecture Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 50	Exam Marks	: 80

MODULE 1

Production development through CIM: Computers in Industrial manufacturing, Product cycle & Production development cycle, Introduction of CAD/CAM & CIM, sequential and concurrent engineering, soft and hard prototyping.

Computer Process Monitoring: Process control methods, direct digital control, supervisory computer control, steady state optimal control, on line search strategies, adaptive control. 10 HRS

MODULE 2

Computer Aided Quality Control: The computer in Q.C, automated inspection principles and methods, Contact inspection methods, non-contact inspection methods, machine vision system, optical inspection method, sensors, coordinate, measuring machine, Computer-Aided testing, Integration of CAQL with CAD/CAM. 10 HRS

MODULE 3

Computer Integrated Manufacturing: Fundamentals of CAD/CAM, Computerized Manufacturing planning systems, shop floor control & automatic identification techniques. Computer Network for manufacturing, and the future automated factor. 10 HRS

MODULE 4

Detroit type of Automation: Flow lines, Transfer Mechanisms, work pattern transfer, Different methods, & Problems.

Analysis of Automated flow lines: Analysis of transfer lines without storage with storage buffer single stage, Double stage, Multistage with problems, Automated assembly systems, Design for automated assembly, parts feeding devices, analysis of Multi station assembly machine, Analysis of Single stage assembly machine, 10 HRS

MODULE 5

Automated material Handling Storage: Material functions, types of material handling equipment, analysis of material handling systems, design of system, conveyor system, automated guided vehicle systems, automated storage/retrieval systems, caroused storage systems work in process storage, interfacing handling & storage with manufacturing.

REFERENCE BOOKS:

1. **CAD/CAM** - Zimmers & Grover – PHI.
2. **CAD/CAM/CIM** - P.Radhakrishna - New Age International - 2nd edition.
3. **Automation, Production systems & Computer Aided Manufacturing** - M.P. Grover - Prentice Hall - 1984.
4. **CAD/CAM** - Zeid – Mc-Graw Hill - 2005.
5. **CAD/CAM** - P.N.Rao - TMH.- 2nd edition, 2004.
6. **Robotics for Engineering** - Koren.Y - Mc-Graw Hill - 1985.
7. **Robot vision & Sensory Controls** - Rooks B. - North Holland. - (ed) vol-3

Elective-I

APPLIED PROBABILITY AND STATISTICS

Sub Code	: 16 MPT 151	IA Marks	: 20
No. of Lecture Hrs/week	: 03	Exam Hours	: 03
Total Lecture Hrs	: 40	Exam Marks	: 80

MODULE 1

Introduction to statistics: Statistical Thinking, Collecting data, Statistical Modeling Frame work, measure of central tendency and variance, Importance of Data summary and Display, Tabular and Graphical display. 6 HRS

MODULE 2

Discrete Random Variables and Probability distribution: Discrete Random variables, Probability distributions and Probability mass functions, Cumulative distribution functions, Mean and Variance of a discrete random variable, discrete uniform distribution, Binominal distribution, Hyper Geometric distribution, Poisson distribution, Applications. 8 HRS

MODULE 3

Continuous Random Variables and Probability Distributions: Continuous random variables, Probability distributions and probability density functions, cumulative distribution functions, Mean and Variance of a continuous random variable, uniform distribution, Normal distribution, Normal approximation to Binominal and Poisson distribution, Exponential distribution. 8 HRS

MODULE 4

Testing of Hypothesis: Estimation theory, Hypothesis testing, Inference on the mean of a population (variance known and unknown), Inference on the variance of a normal population, Inference on a population proportion, Testing for Goodness of Fit, Inference for a difference in Means, Variances known, Inference for a difference in means of two normal distributions, Variances unknown, Inference on the Variances of two normal populations, Inference on two population proportions. 10 RS

MODULE 4

Simple Linear Regressions and Correlation: Simple Linear Regression, Properties of Least square Estimators and Estimation of variances, Transformations to a straight line, Correlation.

Multiple linear regressions : Multiple linear regressions model, least square estimation of parameters, Matrix approach to multiple linear regression, properties of least square estimators and estimation of variance. **8HRS**

TEXT BOOKS:

1. Applied statistics and Probability for Engineers – Douglas C Montgomery, George C Runger, 2nd Edn, John Wiley and Sons, ISBN-0-471-17027-5, 1999.
2. Statistics for Management, Richard I Levin, David S Rubin, 6th Edn, Prentice Hall India, ISBN-81-203-0893-X.

REFERENCES:

1. **Probability and Statistics in Engineering** - William W Hines, Douglas C Montgomery - John Wiley and Sons - 2nd Edn,.
2. **Business Statistics for Management and Economics** - Daniel, Terrell - Houghton Mifflin Company - 6th Edn, ISBN-0-395-62835-0.
3. **Probability and Statistics** - by Walpole & Mayer - MacMillan Publishing Company - 1989.

COMPOSITE MATERIALS

Sub Code	: 16 MPT 152	IA Marks	: 20
No. of Lecture Hrs/week	: 03	Exam Hours	: 03
Total Lecture Hrs	: 40	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 **6 HRS..**

MODULE 2

Micro mechanical analysis of a lamina: Introduction, Evaluation of the four elastic moduli – Rule of mixture, Macro mechanics of a lamina: Hooke’s law for different types of materials, number of elastic constants, Laminate code, Failure criterion. **8 HRS**

MODULE 3

Manufacturing: Lay up and curing – open and closed mould processing – Hand lay up techniques Bag moulding and filament winding. Pultrusion, Pulforming, Thermoforming, Injection moulding, Cutting, Machining and joining, tooling, Quality assurance Introduction, material qualification, types of defects, NDT methods. **8 HRS**

MODULE 4

Fabrication of Composites: Cutting, machining, drilling, mechanical fasteners & adhesive bonding joining computer aided design manufacturing tooling fabrication equipment

Design of Fibre Reinforced Composite structures: Introduction, Composite structural design, Design criteria, Laminate design, Mathematical analysis of the laminate, Design of composite stiffeners. **10 HRS**

MODULE 5

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

Metal matrix composites: Re-inforcement materials, types, Characteristics & Selection, base metals-selection, applications. Powder metallurgy technique, liquid metallurgy technique 8 HRS

TEXT BOOKS:

1. **Composite Materials Handbook** - Mein Schwartz - Mc Graw Hill Book Company - 1984.
2. **Mechanics of Composite Materials** - Autar K.Kaw - CRC Press New York - 1st edi, 1997.

THEORY OF METAL CUTTING

Sub Code	: 16 MPT 153	IA Marks	: 20
No. of Lecture Hrs/week	: 03	Exam Hours	: 03
Total Lecture Hrs	: 40	Exam Marks	: 80

MODULE 1

Mechanics of metal cutting: Mechanism of chip formation, Orthogonal & Oblique cutting, types of chips, built-up edge, Determination of shear plane angle, forces on the chips, forces in orthogonal cutting, Merchant circle diagram and analysis, Theory of Lee & Shaffer, co-efficient of friction, power & energy relationship, velocity relationship, shear-strain, factors affecting forces and power, problems.

Geometry of cutting tools: Single point and multi point cutting tools, tools nomenclature, tool point reference systems, tool angle specifications –ISO and ASA systems, conversion from one system to another. Recommended tool angles, Effect of cutting parameters on tool geometry. 8 HRS

MODULE 2

Tool Materials and their properties: Characteristics of tool materials, types of tool materials – carbon tool steels, high speed steels, cast alloys, cemented carbides, ceramics, diamonds, SIALON, CBN, UCON, recommended cutting speeds for the above tools, discussion on die steels, air, water, oil hardening of tools and their applications.8 HRS

MODULE 3

Measurement of cutting forces: Reasons for measuring cutting forces, Classification of cutting force dynamometers – mechanical, hydraulic, pneumatic, optical, inductance, piezoelectric, and strain gage type dynamometers, Dynamometers for lathe, drilling, and milling, Calibration of dynamometers. 8 HRS

MODULE 4

Tool Wear, Tool life: Mechanisms of tool wear, Sudden & gradual wear, crater wear, flank wear, tool failure criteria, tool life equations, effect of process parameters on tool life, tool life tests, conventional & accelerated tool wear measurement, machinability index

Thermal Aspects in Metal Cutting: Heat sources in metal cutting, temperature in chip formation, temperature distribution, experimental determination of tool temperatures. 8 HRS

MODULE 5

Cutting fluids: Basic actions of cutting fluids, properties of cutting fluids, selection of cutting fluids, application of cutting fluids, filtration of fluids, recommended cutting fluids.

Economics of Machining: Introduction, elements of total production cost, optimum cutting speed and tool life for minimum cost, optimum cutting speed and tool life for maximum production, problems. 8 HRS

REFERENCE BOOKS

1. **Metal Cutting Principles** - M.C. Shaw - Oxford Publication – 1985.
2. **Fundamentals of metal cutting & Machine Tools** - by B.L.Juneja & G.S – Sekhar - Wiley Eastern.
3. **Metal Cutting** - V.C.Venkatesh & S.Chandrasekhanan - Pantice Hall – 1991.
4. **Metal Cutting** - Dr. B.J.Ranganath -Vikas Publications.

ADVANCED MATERIALS & PROCESSING

Sub Code	: 14 MPT 154	IA Marks	: 50
No. of Lecture Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

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.

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.

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

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.

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 - Mc Millan, 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.

Laboratory Exercises

16 MPT 16

01. To become familiar with the use of a kinematics graphics simulator in order to perform robot motion and programming.
02. To use trajectory planning concepts on the model of a single-link robotic manipulator.
03. To familiarize students with the use of a vision system.
04. Simulation of Cutting/Milling operations on a computer using CAM packages.
05. To simulate a manufacturing system using discrete-event simulation techniques. To enable students to have a Systems-Wide View of manufacturing systems. A 3-D graphics manufacturing-oriented simulation software on a PC-type computer should be used. A simple manufacturing system is modelled first and the effects of local changes examined.. Then, students make changes to the manufacturing system in order to increase throughput, reduce in-process inventories, and so on. The effects of resource failure and repair times are also examined.

REFERENCE BOOKS:

8. **CAD/CAM** - Zimmers & Grover – PHI.
9. **CAD/CAM/CIM** - P.Radhakrishna - New Age International - 2nd edition.
10. **Automation, Production systems & Computer Aided Manufacturing** - M.P. Grover - Prentice Hall - 1984.
11. **CAD/CAM** - Zeid – Mc-Graw Hill - 2005.
12. **CAD/CAM** - P.N.Rao - TMH.- 2 nd edition, 2004.
13. **Robotics for Engineering** - Koren.Y - Mc-Graw Hill - 1985.
14. **Robot vision & Sensory Controls** - Rooks B. - North Holland. - (ed) vol-3