## Scheme of Teaching and Examination for M.Tech.-Production Engineering & System Technology (MPT)

### I Semester

<table>
<thead>
<tr>
<th>Subject Code</th>
<th>Name of the Subject</th>
<th>Teaching hours/week</th>
<th>Duration of Exam in Hours</th>
<th>Marks for Total Marks</th>
<th>CREDITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>14 MPT 11</td>
<td>Quality &amp; Reliability Engineering</td>
<td>4 Lecture, 2 Field Work, 3 Tutorial</td>
<td>3</td>
<td>50 I.A., 100 Exam</td>
<td>150 4</td>
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<tr>
<td>14 MPT 12</td>
<td>Quantitative Techniques in Decision Making</td>
<td>4 Lecture, 2 Field Work</td>
<td>3</td>
<td>50 I.A., 100 Exam</td>
<td>150 4</td>
</tr>
<tr>
<td>14 MPT 13</td>
<td>Operations Management</td>
<td>4 Lecture, 2 Field Work</td>
<td>3</td>
<td>50 I.A., 100 Exam</td>
<td>150 4</td>
</tr>
<tr>
<td>14 MPT 14</td>
<td>Computer Integrated Manufacturing &amp; Automation</td>
<td>4 Lecture, 2 Field Work</td>
<td>3</td>
<td>50 I.A., 100 Exam</td>
<td>150 4</td>
</tr>
<tr>
<td>14 MPT 15x</td>
<td>Elective - I</td>
<td>4 Lecture, 2 Field Work</td>
<td>3</td>
<td>50 I.A., 100 Exam</td>
<td>150 4</td>
</tr>
<tr>
<td>14 MPT 16</td>
<td>Lab Component</td>
<td>2 Field Work, 3 Exam</td>
<td>3</td>
<td>25 I.A., 50 Exam</td>
<td>75 2</td>
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<tr>
<td>14 MPT 17</td>
<td>Seminar</td>
<td>2 Field Work, 3 Exam</td>
<td>--</td>
<td>25 I.A., --</td>
<td>25 1</td>
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<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>20 Lecture, 13 Field Work, 15 Exam</strong></td>
<td></td>
<td><strong>300 I.A., 550 Exam</strong></td>
<td><strong>850 23</strong></td>
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</table>

**Elective – I**

<table>
<thead>
<tr>
<th>Sub. Code</th>
<th>Name of the Subject</th>
</tr>
</thead>
<tbody>
<tr>
<td>14 MPT 151</td>
<td>Applied Probability and Statistics</td>
</tr>
<tr>
<td>14 MPT 152</td>
<td>Composite Materials</td>
</tr>
<tr>
<td>14 MPT 153</td>
<td>Theory of Metal Cutting</td>
</tr>
<tr>
<td>14 MPT 154</td>
<td>Advanced Materials &amp; Processing</td>
</tr>
<tr>
<td>14 MPT 155</td>
<td>Theory of Metal Forming</td>
</tr>
</tbody>
</table>
# VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM

**SCHEME OF TEACHING AND EXAMINATION FOR**

**M.TECH.-PRODUCTION ENGINEERING & SYSTEM TECHNOLOGY (MPT)**

## II Semester

<table>
<thead>
<tr>
<th>Subject Code</th>
<th>Name of the Subject</th>
<th>Lecture</th>
<th>Practical / Field Work / Assignment / Tutorials</th>
<th>Duration of Exam in Hours</th>
<th>Marks for Total Marks</th>
<th>CREDITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>14 MPT 21</td>
<td>Industrial Robotics</td>
<td>4</td>
<td>2</td>
<td>3</td>
<td>50 100 150</td>
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<tr>
<td>14 MPT 22</td>
<td>Agile Manufacturing</td>
<td>4</td>
<td>2</td>
<td>3</td>
<td>50 100 150</td>
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<tr>
<td>14 MPT 23</td>
<td>Simulation &amp; Modeling of Manufacturing Systems</td>
<td>4</td>
<td>2</td>
<td>3</td>
<td>50 100 150</td>
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<tr>
<td>14 MPT 24</td>
<td>Lean Manufacturing Systems</td>
<td>4</td>
<td>2</td>
<td>3</td>
<td>50 100 150</td>
<td>4</td>
</tr>
<tr>
<td>14 MPT 25x</td>
<td>Elective- II</td>
<td>4</td>
<td>2</td>
<td>3</td>
<td>50 100 150</td>
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<tr>
<td>14MPT26</td>
<td>Lab Component</td>
<td>3</td>
<td>3</td>
<td>25</td>
<td>50 75 2</td>
<td>2</td>
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<tr>
<td>14MPT27</td>
<td>Seminar</td>
<td>--</td>
<td>3</td>
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<tr>
<td></td>
<td><strong>Project Phase-I(6 week Duration)</strong></td>
<td>--</td>
<td>--</td>
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<td>13</td>
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<td>300 550 850</td>
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## Elective – II

<table>
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<th>Name of the Subject</th>
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<tbody>
<tr>
<td>14 MPT 251</td>
<td>Non-Destructive Testing</td>
</tr>
<tr>
<td>14 MPT 252</td>
<td>Surface Treatment &amp; Finishing</td>
</tr>
<tr>
<td>14 MPT 253</td>
<td>Non-Traditional Machining Processes</td>
</tr>
<tr>
<td>14 MPT 254</td>
<td>Supply Chain Management</td>
</tr>
<tr>
<td>14 MPT 255</td>
<td>Product Data Management</td>
</tr>
</tbody>
</table>
** Between the II Semester and III Semester, after availing a vocation of 2 weeks.

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

III Semester: INTERNSHIP

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Subject</th>
<th>No. of Hrs./Week</th>
<th>Duration of the Exam in Hours</th>
<th>Marks for</th>
<th>Total Marks</th>
<th>CREDITS</th>
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<tr>
<td></td>
<td></td>
<td>Lecture</td>
<td>Practical / Field Work</td>
<td></td>
<td>I.A.</td>
<td>Exam</td>
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<tr>
<td>14MPT31</td>
<td>Seminar / Presentation on Internship (After 8 weeks from the date of commencement)</td>
<td>-</td>
<td>-</td>
<td>25</td>
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<tr>
<td>14MPT32</td>
<td>Report on Internship</td>
<td>-</td>
<td>-</td>
<td>75</td>
<td>75</td>
<td>15</td>
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<tr>
<td>14MPT33</td>
<td>Evaluation and Viva-voce</td>
<td>-</td>
<td>-</td>
<td>50</td>
<td>50</td>
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<td></td>
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### IV Semester

<table>
<thead>
<tr>
<th>Subject Code</th>
<th>Subject</th>
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<th>Duration of Exam in Hours</th>
<th>Marks for Total Marks</th>
<th>CREDITS</th>
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<tbody>
<tr>
<td>14MPT41</td>
<td>Advanced Manufacturing Practices</td>
<td>4</td>
<td>3</td>
<td>50</td>
<td>100</td>
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<tr>
<td>14MPT42</td>
<td>Elective-III</td>
<td>4</td>
<td>3</td>
<td>50</td>
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<tr>
<td>14MPT43</td>
<td>Evaluation of Project Phase-II</td>
<td>-</td>
<td>-</td>
<td>25</td>
<td>-</td>
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<tr>
<td>14MPT44</td>
<td>Evaluation of Project Phase-III</td>
<td>-</td>
<td>-</td>
<td>25</td>
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<tr>
<td>14MPT45</td>
<td>Evaluation of Project Work and Viva-voce</td>
<td>-</td>
<td>3</td>
<td>-</td>
<td>100+100</td>
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</table>

**Total**  
12 07 09 150 400 550 28

**Grand Total (I to IV Sem.)**: 2400 Marks; 94 Credits

### Elective – III

<table>
<thead>
<tr>
<th>Sub. Code</th>
<th>Name of the Subject</th>
</tr>
</thead>
<tbody>
<tr>
<td>14 MPT 421</td>
<td>Industrial Design &amp; Ergonomics</td>
</tr>
<tr>
<td>14 MPT 422</td>
<td>Human Resource Management</td>
</tr>
<tr>
<td>14 MPT 423</td>
<td>Advanced Fluid Power Systems</td>
</tr>
<tr>
<td>14 MPT 424</td>
<td>Project Management</td>
</tr>
<tr>
<td>14 MPT 425</td>
<td>Nano Technology</td>
</tr>
</tbody>
</table>
Note:

1) Project Phase – I: 6 weeks duration shall be carried out between II and III Semesters. Candidates in consultation with the guides shall carryout literature survey / visit to Industries to finalise the topic of dissertation.

2) Project Phase – II: 16 weeks duration. 3 days for project work in a week during III Semester. Evaluation shall be taken during the first two weeks of the IV Semester. Total Marks shall be 25.


Marks of Evaluation of Project:

- The I.A. Marks of Project Phase – II & III shall be sent to the University along with Project Work report at the end of the Semester.

4) During the final viva, students have to submit all the reports.

5) The Project Valuation and Viva-Voce will be conducted by a committee consisting of the following:

a) Head of the Department (Chairman)
b) Guide
c) Two Examiners appointed by the university. (out of two external examiners at least one should be present).
QUALITY AND RELIABILITY ENGINEERING

Sub Code : 14 MPT 11 IA Marks : 50
No. of Lecture Hrs/week : 04 Exam Hours : 03
Total Lecture Hrs : 52 Exam Marks : 100

Basic Concepts: Definitions of quality and Reliability, Parameters and Characteristics, Quality control, statistical Quality Control, Reliability concepts.


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.

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.

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

REFERENCE BOOKS:

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


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


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.

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.

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/l queuing model.

Simulation of Management systems: Simulation and Monte Carlo method, Waiting lineand inventory simulation models

Text Books:

REFERENCE BOOKS:
OPERATIONS MANAGEMENT

Sub Code                          : 14MPT13            IA Marks      : 50
No. of Lecture Hrs/week : 04  Exam Hours : 03
Total Lecture Hours        : 52  Exam Marks : 100

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.

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.

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.

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, framework 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.

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:

- **Production And Operations Management: Edition 3**, R. PANNEERSELVAM, PHI Learning Pvt, Ltd
COMPUTER INTEGRATED MANUFACTURING & AUTOMATION

<table>
<thead>
<tr>
<th>Sub Code</th>
<th>: 14 MPT 14</th>
<th>IA Marks</th>
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</thead>
<tbody>
<tr>
<td>No. of Lecture Hrs/week</td>
<td>: 04</td>
<td>Exam Hours</td>
<td>: 03</td>
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<tr>
<td>Total Lecture Hrs</td>
<td>: 52</td>
<td>Exam Marks</td>
<td>: 100</td>
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</tbody>
</table>

**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.

**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.


**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.

**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.
**Elective-I**

**APPLIED PROBABILITY AND STATISTICS**

<table>
<thead>
<tr>
<th>Sub Code</th>
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<th>Total Lecture Hrs</th>
<th>Exam Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>14 MPT 151</td>
<td>50</td>
<td>04</td>
<td>03</td>
<td>52</td>
<td>100</td>
</tr>
</tbody>
</table>

**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.

**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.

**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.

**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.

**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.

**TEXT BOOKS:**

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


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.

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.

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

TEXT BOOKS:

THEORY OF METAL CUTTING

Sub Code : 14 MPT 153  
No. of Lecture Hrs/week : 04  
Total Lecture Hrs : 52  
IA Marks : 50  
Exam Hours : 03  
Exam Marks : 100

**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.

**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.

**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.

**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.

**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.

**REFERENCE BOOKS**

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.


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.


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
THEORY OF METAL FORMING

Sub Code : 14 MPT 155  
IA Marks : 50  
No. of Lecture Hrs/week : 04  
Exam Hours : 03  
Total Lecture Hrs : 52  
Exam Marks : 100


Forging: Classification, various stages during forging. Forging equipment, brief description, deformation in compression, forging defects. Residual stresses in forging.

Rolling of Metals: Classification, forces and geometrical relationships in rolling.

Variables in rolling: Deformation in rolling, Defects in rolled products, Residual stresses in rolled products. Torque and Horsepower.

Extrusion: Classification, Extrusion equipment, variables in extrusion, Deformation in extrusion, Extrusion defects, Work done in extrusion.

Drawing: Principles of Rod and wire drawing, variables in wire drawing, Residual stresses in rod, wire and tube drawing, Defects in Rod and wire drawing.

Sheet Metal forming: Introduction, Forming methods, shearing and Blanking, Bending, stretch forming, Deep drawing, redrawing operations, Defects in formed products.

REFERENCE BOOKS:

Laboratory Exercises

14 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.


COMPUTER CONSIDERATIONS FOR ROBOTIC SYSTEMS: Computer architecture for robots, hardware, Computational elements in robotic applications – Robot programming – sample programs path planning – Robot’s computer system.


APPLICATIONS OF ROBOTS: Capabilities of Robots – Robotics Applications – Obstacle avoidance – Robotics in India – The future of Robotics

TEXT BOOKS:


REFERENCE BOOKS:

AGILE MANUFACTURING


Four Core Concepts: Strategy driven approach - integrating organization, people technology interdisciplinary design methodology.

Agile Manufacturing and Change Management: The change implications. Post failures in advanced manufacturing, changes on the way, traditional management accounting, paradigm, investment appraisal, product costing - performance, measurement and control systems, Traditional organization, control technological and design paradigms traditional problems in workplace- organizational issues - role of technology.

Agile Manufacturing Enterprise Design: Agile manufacturing - enterprise design.. system concepts as the basic manufacturing theory - joint technical & organizational design and a model for the design of agile manufacturing enterprise, enterprise design process insights into design processes, what is interdisciplinary design. Main issues - simple design example.


REFERENCE BOOKS:

SIMULATION AND MODELING OF MANUFACTURING SYSTEMS

<table>
<thead>
<tr>
<th>Sub Code</th>
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<td>50</td>
<td>04</td>
<td>03</td>
<td>52</td>
<td>100</td>
</tr>
</tbody>
</table>

**Principle of Computer Modelling 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.

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

**Statistical Models in Simulation:** Discrete distributions, continuous distributions.

**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.

*** Ivica Cmkovic, Ulfaskluna and Annita borsen Dohlgvist Publisher Artechhouse.

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

**Empirical Discrete Distribution:** Discrete uniform -distribution poisson distribution -geometric distribution -acceptance -rejection technique for Poisson distribution gamma distribution.

**Design and Evaluation of Simulation Experiments:** variance reduction techniques -antithetic variables, variables-verification and validation of simulation models.

**Simulation Software:** Selection of simulation software, simulation packages.

**TEXT BOOKS:**


**REFERENCE BOOKS:**

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

Kanban system:- Kanban rules supplier Kanban and sequence schedule used by supplier.  Monthly information & daily information. Later replenish system by Kanban sequenced withdrawal P system by sequence schedule table - problems & counter measures in applying Kanban system to subcontractors -Supplier Kanban circulation in the paternal manufacturer -structure of supplier Kanban sorting office. The rise & fall of Mass Production Mass production, work force, organization, tools, product –logical limits of mass production, Sloan as a necessary compliment to Ford. Case study:- Rouge Production Plant.

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.

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

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.

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

REFERENCE BOOKS:

NON-DESTRUCTIVE TESTING

Sub Code : 14 MPT 251
IA Marks : 50
No. of Lecture Hrs/week : 04
Exam Hours : 03
Total Lecture Hrs : 52
Exam Marks : 100

Introduction to ND testing: selection of ND methods, visual inspection, leak testing, Liquid penetration inspection, its advantages and limitation.

Magnetic particle inspection: Methods of generating magnetic field, types of magnetic particles and suspension liquids steps in inspection – application and limitations

Eddy current inspection: principles, operation variables, procedure, inspection coils, and detectable discounts by the method.

Microwave inspection: Microwave holography, applications and limitations.

Ultrasonic inspection: Basic equipment characteristics of ultrasonic waves, variables inspection, inspection methods pulse echo A,B,C scans transmission, resonance techniques, transducer elements couplets, search units, contact types and immersion types inspection standards-standard reference blocks,

Radiography inspection: principles, radiation source X-rays and gamma rays, X-ray-tube, radio graphic films, neutron radiography, Thermal inspection principles, equipment inspection methods applications.

Optical Holography: Basics of Holography, recording and reconstruction - Acoustical Holography: systems and techniques applications. Indian standards for NDT.

REFERENCE BOOKS:

SURFACE TREATMENT & FINISHING

Sub Code : 14 MPT 252  
IA Marks : 50
No. of Lecture Hrs/week : 04  
Exam Hours : 03
Total Lecture Hrs : 52  
Exam Marks : 100


Vacuum coating, FVD & CVD metal spraying - Methods, surface preparation, mechanical

Properties of sprayed metals, plasma coating.

Plastic coating of metal - PVC coating Spherodising process details, phosphate coating - mechanism of formation.

Testing of surface coating methods.

Heat treatment methods, Aneleaving, Normalizing, Tempering, Case hardening methods, flame hardening sub zero treatment.

Heat treatment methods for gears, spindles, cutting tools.

Advanced coating technologies: Hard facing, electro deposition technique, nanocoatings, coating characterization

REFERENCE BOOKS:

5. Metals Hand Book – ASM.
NON-TRADITIONAL MACHINING PROCESS

<table>
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<th>: 14 MPT 253</th>
<th>IA Marks</th>
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**Introduction:** Need for non-traditional machining processes. Processes selection classification on – comparative study of different 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.

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


**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.

**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

**High Velocity forming process:** introduction - development of specific process selection-comparison of conventional and high velocity forming methods - Types of high velocity forming methods- explosion forming process-elector hydraulics forming magnetic pulse forming.

**REFERENCE BOOKS:**

1. New technology Institution of Engineers - Bhattacharya - India
### SUPPLY CHAIN MANAGEMENT

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**Facility Location and Network Design:** Models for facility location and capacity allocation. Impact of uncertainty on SCN – discounted cash flow analysis, evaluating network design decisions using decision using decision trees. Analytical problems.

**Planning and Managing Inventories in a Supply Chain:** Review of inventory concepts. Trade promotions, Managing multi-echelon cycle inventory, safety inventory determination. Impact of supply uncertainty aggregation and replenishment policies on safety inventory. Optimum level of product availability; importance factors. Managerial levers to improve supply chain profitability.

**Sourcing, Transportation and Pricing Products:** Role of sourcing, supplier – scoring & assessment, selection and contracts. Design collaboration.


**Coordination and Technology in the Supply Chain:** Co-ordination in a supply chain: Bullwhip effect. Obstacles to coordination. Managerial levers to achieve co-ordination, Building strategic partnerships.

**Coordination and Technology in the Supply Chain:** The role of IT supply Chain, The Supply Chain IT framework, CRM, Internal SCM, SRM. The role of E-business in a supply chain, The E-business framework, E-business in practice. Case discussion.

**Emerging Concepts:** Reverse Logistics; Reasons, Activities, Role. RFID Systems; Components, applications, implementation. Lean supply chains, Implementation of Six Sigma in Supply Chains.

**REFERENCE BOOKS:**

PRODUCT DATA MANAGEMENT

<table>
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**Introduction**: Introduction to PDM-present market constraints need for collaboration- Internet and developments in server-client computing.

**Components of PDM**: Components of a typical PDM set-up hardware and software- document management creation and viewing of documents -creating parts-version control of parts and documents –case studies.

**Configuration Management**: Base lines-product structure configuration management -case studies.


**Change Management**: Change issue -change request-change investigation- change proposal-change activity-case studies.

**Generic Products and Variants**: Products configuration comparison between sales configuration mild products generic-generic product modeling in configuration modeler-use of order generator for variant creation -registering of variants in product register-case studies.

**REFERENCE BOOKS:**


Perform any Eight / Ten experiments:

2. Determination of Chip reduction co-efficient (reciprocal of chip thickness ratio) during single point turning.
3. Forces measurements during orthogonal turning.
4. Estimation of Power required during orthogonal turning.
5. Torque and Thrust measurement during drilling.
8. Study the variation of surface roughness with different speed and feed during plain milling operation on flat surface.
9. Study of capstan lathe and its tooling and prepare a tool layout & job as per given drawing.
10. To prepare metallic samples for metallographic examination and to study the principle & construction of the Metallurgical Microscope.
11. Study of Microstructure and Hardening of steel in different medium and cooling rates.
12. Effect of Carbon percentage on the hardness of Steel.
13. CNC milling- Writing and execution of part program for contour milling.

REFERENCE BOOKS

8. **Metal Cutting** - Dr. B.J.Ranganath -Vikas Publications.
ADVANCED MANUFACTURING PRACTICES

Sub Code : 14 MPT 41
IA Marks : 50
No. of Lecture Hrs/week : 04
Exam Hours : 03
Total Lecture Hrs : 52
Exam Marks : 100

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.

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.
   a) Sequenced Withdrawal System.
   b) 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.

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.

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.

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.

TEXT BOOKS:
REFERENCE BOOKS:

1. An Integrated Approach To Just In Time - Yasuhiro Monden - Toyota Production system.
ELECTIVE III

INDUSTRIAL DESIGN AND ERGONOMICS

Sub Code : 14 MPT 421
IA Marks : 50
No. of Lecture Hrs/week : 04
Exam Hours : 03
Total Lecture Hrs : 52
Exam Marks : 100

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.

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., - design of furniture design of instruments.

Ergonomics and Production: Ergonomics and product design ergonomics in automated systems-expert systems for ergonomic design, Anthropomorphic data and its applications in ergonomic design limitations of anthropomorphic data - use of computerized database.

Visual Effects of Line and Form: The mechanics of seeing psychology of seeing, general influences of lined 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 engineering equipments.

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

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

TEXT BOOKS:

HRM in perspective, competitive challenges, uses of HR information, Demographics and employee concerns, social issues, diversity in HRM.

Relationship of Job Requirements and HRM functions, Job Analysis, Job Description, Job Design, Designing work for groups, flexible work schedules, Industrial engineering and ergonomic consideration, HR Planning, Effective HRP, Forecasting and balancing supply and demand of HR, recruiting from inside and outside, Recruiting protected class, Recruiting older people.

Selection, Matching people and job, sources of information about job candidate, The US Employee Polygraph Protection Act, graphology, Medical examination, Drug test, Interview methods Guidelines for interviewers, appropriate and inappropriate interview questions, selection decision.

Developing effectiveness in HR, Investment in Training, System approach, Conducting the needs assessment, designing training programs, trainee readiness and motivation, principles of learning, characteristics of trainees, training methods for non-managerial employees, OJT, Technology for training, training methods for MDP, Evaluating, benchmarking HR training.

Career development and Appraisal, identifying career opportunity and requirements, gauging employee potential, career development initiative, Mentor checklist, career development for women and minorities, dual career couples, personal career development, Behavioral methods of appraisal, balanced score card, personal score card appraisal interviews; performance diagnosis

International HRM, Managing across borders, International staffing, Skills of a global manager, content of training program. Non-verbal communications, developing local resources, compensation of host country employees, managers and expatriate managers.

Case studies on appraisal system, developing a training session, evaluating a given training program, preparation of structured and unstructured interviews

REFERENCES

2. **Managing Human Resources** - George Bohlander and Scot Snell - Thompson South western.
4. **Human Resource Management** - K. Ashwathappa,
ADVANCED FLUID POWER SYSTEMS

Sub Code: 14 MPT 423
IA Marks : 50
No. of Lecture Hrs/week : 04
Exam Hours : 03
Total Lecture Hrs : 52
Exam Marks : 100


Hydraulic Power Unit: Introduction, Pumping Theory, Pump Classification, Gear Pumps, (Vane Pumps- simple, balanced & pressure compensated vane pump, Vane design) Piston Pumps- Radial, Axial (Bent axis & Swash plate), Pump Performance, Pump Noise, Ripple in pumps.

Hydraulic Actuators: Linear actuator- cylinders, Mechanics of Hydraulic cylinder loading, limited rotation hydraulic actuator, cylinder cushioning, Gear, Vane & Piston motor, Motor performance, Hydrostatic transmission

Power Controlling Elements – Valves:
- Directional Control Valves – Classification, 2/2, 3/2, 4/2 & 4/3 ways Dcv’s. Different Centre configurations in 4/3 way valves, actuation of DCV’s, Indirect actuation, Valve Lap – Lap during Stationary and during switching.
- Pressure Control Valves: Classification, opening & Closing Pressure difference, Cracking Pressure, Pressure Relief Valve – Simple & Compound type, Pressure reducing valve, sequence, unloading & Counter balance valve, Pressure switches.

iv) Check valve, Pilot operated check valve.


Pneumatic Valve: Directional control valves, impulse valve, Quick exhaust valve, shuttle valve, Twin pressure valve, Time delay valve,

Pneumatic Circuit & Logic Circuits:- Control of single and double acting cylinder, impulse operation, speed control, sequencing, Pneumatic Vacuum system AND,OR, NOT, NAND, NOR, YES Function, Logic circuits design using shuttle valve & twin pressure valve, Binary Arithmetic, logic & Boolean Algebra, use of kannaugh veitch map for pneumatic circuit design.

Electrical Control in Fluid Power: Contactors, & Switches, Relays, Limit switch, Electro hydraulic & Electro Pneumatic Circuits, Simple Cylinder reciprocation, interlocking using relays, Proximity switches, application of proximity switches, Time dependent will dependent and travel dependent circuits.

REFERENCE BOOKS:

2. Oil hydraulics -Principles & maintenance - S.R. Majumdar - Tata M C Graw Hill
3. Components & Application - Bosch Rexroth didactic - Hydraulics Trainer - vol 1. Publication
5. Pneumatics: Theory and Applications - Bosch Rexroth didactic - Publication
### PROJECT MANAGEMENT

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**Introduction:** Identification of Investment Opportunities, Market and Demand Analysis – Technical Analysis - Investment Outlay.

**Means of Financing** - Profitability and Breakeven Analysis - Cash Flows of Projects - Tax factor in investment Analysis - Interest Compounding and Discounting.

**Appraisal Criteria and Selection of Investment** - cost of capital analysis of Risk - Financial Projection, social Cost Benefit Analysis


**Networks Techniques in Project Management** - PERT/CPM Analysis - Administrative aspects of Capital Investment.

**REFERENCE BOOKS:**

1. **Projects - appraisal, preparation, budgeting and implementation** – Prasannachandra - Tata MCgraw hill.
2. **Handbook of Project Management** - Dennis lock.
NANO TECHNOLOGY

Sub Code: 14 MPT 425  
IA Marks: 50

No. of Lecture Hrs/week: 04  
Exam Hours: 03

Total Lecture Hrs: 52  
Exam Marks: 100

Metal based nanocomposites- Metal-Oxide or Metal-Ceramic composites, Different aspects of their preparation techniques and their final properties and functionality. Metal-metal nanocomposites, some simple preparation techniques and their new electrical and magnetic properties.

Design of Super hard materials- Super hard nanocomposites, its designing and improvements of mechanical properties.

Nanofiller synthesis, applications, Polymer nanocomposites, particulate and fibre modified nanocomposites, matrices and fibres, polymer- filler interphase, pull- out strength, effect of various treatments.


Polymer-carbon nanotubes based composites, processing methods and characterization using SEM, XRD, TEM

Characterization of Polymer nanotubes based composites for Mechanical, Electrical and Thermal Properties and their applications - Polymer / nanofillers (metallic nanopowders) systems, Rheological measurements, processing characteristics

Testing of nanocomposites, Thermal analysis such as TGA, TMA, DSC, DMTA

REFERENCE BOOKS: