# Scheme of Teaching and Examination for M.Tech.-Production Management (MPM)

## 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>
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<tbody>
<tr>
<td>14 MPM 11</td>
<td>Theory of Metal Cutting</td>
<td>4</td>
<td>3</td>
<td>50 100 150</td>
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<tr>
<td>14 MPM 12</td>
<td>Quantitative Techniques in Decision Making</td>
<td>4</td>
<td>3</td>
<td>50 100 150</td>
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<td>14 MPM 13</td>
<td>Theory of Metal Forming</td>
<td>4</td>
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<td>50 100 150</td>
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<tr>
<td>14 MPM 14</td>
<td>Computer Integrated Manufacturing &amp; Automation</td>
<td>4</td>
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<td>14 MPM 15x</td>
<td>Elective - I</td>
<td>4</td>
<td>3</td>
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<td>14 MPM 16</td>
<td>Lab Component</td>
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## Elective – I

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<tbody>
<tr>
<td>14 MPM 151</td>
<td>Quality &amp; Reliability Engineering</td>
</tr>
<tr>
<td>14 MPM 152</td>
<td>Composite Materials</td>
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<tr>
<td>14 MPM 153</td>
<td>Supply Chain Management</td>
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<tr>
<td>14 MPM 154</td>
<td>Advanced Materials &amp; Processing</td>
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**II 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>
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<th>CREDITS</th>
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<tbody>
<tr>
<td>14 MPM 21</td>
<td>Industrial Robotics</td>
<td>4 Lecture 2</td>
<td>3</td>
<td>50</td>
<td>100</td>
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<tr>
<td>14 MPM 22</td>
<td>Advanced Foundry Technology</td>
<td>4 Lecture 2</td>
<td>3</td>
<td>50</td>
<td>100</td>
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<tr>
<td>14 MPM 23</td>
<td>Operations Management</td>
<td>4 Lecture 2</td>
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<td>4 Lecture 2</td>
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<td>100</td>
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<tr>
<td>14 MPM 25x</td>
<td>Elective- II</td>
<td>4 Lecture 2</td>
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<td>14 MPM 26</td>
<td>Lab Component</td>
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<td>14 MPM 27</td>
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<td><strong>Project Phase-I(6 week Duration)</strong></td>
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**Elective – II**

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<tbody>
<tr>
<td>14 MPM 251</td>
<td>Non-Destructive Testing</td>
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<tr>
<td>14 MPM 252</td>
<td>Surface Treatment &amp; Finishing</td>
</tr>
<tr>
<td>14 MPM 253</td>
<td>Non-Traditional Machining Processes</td>
</tr>
<tr>
<td>14 MPM 254</td>
<td>Simulation &amp; Modeling of Manufacturing Systems</td>
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</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 MANAGEMENT (MPM)**

### III Semester: INTERNSHIP

#### CREDIT BASED

<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 Total Marks</th>
<th>CREDITS</th>
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<tbody>
<tr>
<td>14MPM31</td>
<td>Seminar / Presentation on Internship (After 8 weeks from the date of commencement)</td>
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<tr>
<td>14MPM32</td>
<td>Report on Internship</td>
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<tr>
<td>14MPM33</td>
<td>Evaluation and Viva-voce</td>
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</table>
# Scheme of Teaching and Examination for M.Tech.-Production Management (MPM)

## IV Semester

<table>
<thead>
<tr>
<th>Subject Code</th>
<th>Subject</th>
<th>No. of Hrs./Week</th>
<th>Duration of Exam in Hours</th>
<th>Marks for Total Marks</th>
<th>CREDITS</th>
</tr>
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<tbody>
<tr>
<td></td>
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<td>Lecture</td>
<td>Field Work / Assignment / Tutorials</td>
<td>I.A.</td>
<td>Exam</td>
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<tr>
<td>14MPM41</td>
<td>Advanced Joining Process</td>
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<td>3</td>
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<td>14MPM42</td>
<td>Elective-III</td>
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<td>14MPM43</td>
<td>Evaluation of Project Phase-II</td>
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<td>14MPM44</td>
<td>Evaluation of Project Phase-III</td>
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<td>14MPM45</td>
<td>Evaluation of Project Work and Viva-voce</td>
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**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>
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<tbody>
<tr>
<td>14 MPM 421</td>
<td>Industrial Design &amp; Ergonomics</td>
</tr>
<tr>
<td>14 MPM 422</td>
<td>Human Resource Management</td>
</tr>
<tr>
<td>14 MPM 423</td>
<td>Advanced Fluid Power Systems</td>
</tr>
<tr>
<td>14 MPM 424</td>
<td>Project Management</td>
</tr>
<tr>
<td>14 MPM 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).
THEORY OF METAL CUTTING

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.
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/1 queuing model.

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

Text Books:

REFERENCE BOOKS:
THEORY OF METAL FORMING

Sub Code : 14 MPM 13 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:


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

QUALITY AND RELIABILITY ENGINEERING

Sub Code : 14 MPM 151
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:
COMPOSITE MATERIALS

Sub Code : 14 MPM 152
IA Marks : 50
No. of Lecture Hrs/week : 04
Exam Hours : 03
Total Lecture Hrs : 52
Exam Marks : 100

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:

SUPPLY CHAIN MANAGEMENT

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


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:

5. Going Backwards Reverse Logistics Trends and Practices -Dr. Dale S. Rogers,Dr. Ronald S. Tibben-Lembke,University of Nevada, Reno, Center for Logistics Management.
ADVANCED MATERIALS & PROCESSING

<table>
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<td>Total Lecture Hrs</td>
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<td>Exam Marks</td>
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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
Laboratory Exercises

14 MPM 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.


COMPUTER CONSIDERATIONS FOR ROBOTIC SYSTEMS: Computer architecture for robts, 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:

ADVANCED FOUNDRY TECHNOLOGY

Subject Code : 14 MPM 22 IA Marks : 50
No. of Lecture Hours/Week : 04 Exam Hours : 03
Total No. of Lecture Hours : 52 Exam Marks : 100


Design of Casting: Factors to be considered in casting design. Design consideration in pattern making, moulding techniques and core making and assembly. Cooling stresses and hot spots in casting and modification in casting geometry to overcome them.

Casting Quality Control: Casting defects and factors responsible for them. Different inspection and testing methods to evaluate the casting. Quality control activities in a foundry. Salvaging methods of defective casting.


Malleable Cast Iron: Chemical composition and structure of White-heart and black-heart malleable cast iron. Melting malleabilisation heat treatment and application of malleable cast iron.


Steel Casting Practice: Common steel casting, their composition,structure and properties. Melting and refining of steel. Gating andrisering of steel castings cleaning of steel castings.

Aluminium Foundry Practice: Composition, properties and application of common aluminium alloy casting. Melting and casting of Al-alloys. Gating and risering of Al-alloy casting.

Copper alloy Foundry Practice: General characteristics of common cast copper alloys. Melting and casting of copper alloys. Gating and risering of cu-alloy castings.


REFERENCE BOOKS:

3. Foundry Technology - Beelely, P.R. – Butterworth.
OPERATIONS MANAGEMENT

Sub Code : 14 MPM 23
IA Marks : 50
No. of Lecture Hrs/week : 04
Exam Hours : 03
Total Lecture Hrs : 52
Exam Marks : 100


System Design and Capacity : Introduction, Manufacturing and service systems, Design and systems capacity, Capacity planning.

Forecasting Demand: Forecasting objectives and uses, Forecasting variables, Opinion and Judgmental methods, Time series methods, Moving Average methods , Exponential smoothing, Trend adjusted Exponential Smoothing, Regression and correlation methods, Application and control of forecasts-Mean Absolute Deviation, BIAS, Tracking Signal.

Aggregate Planning and Master Scheduling: Introduction- planning and scheduling, Objectives of aggregate planning, Three Pure Strategies, Aggregate planning methods, Master scheduling objectives, Master scheduling methods.

Material and Capacity Requirements Planning : Overview: MRP and CRP, MRP: Underlying concepts, System parameters, MRP logic, System refinements, Capacity management, CRP activities.

Scheduling and Controlling Production Activities: Introduction, PAC, Objectives and Data requirements, Loading –Finite and Infinite Scheduling methodology, priority sequencing, capacity control.

Single Machine Scheduling : Concept, measures of performance, SPT rule, Weighted SPT rule, EDD rule.

Flow –Shop Scheduling: Introduction, Johnson’s rule for ‘n’ jobs on 2 and 3 machines, CDS heuristic.
Job-Shop Scheduling: Types of schedules, Heuristic procedure, scheduling 2 jobs on ‘m’ machines.

Text Books:
2. Productions & operations management by Adam & Ebert.
3. Pannerselvam. R., Production and Operations Management, PHI.

References:
TOTAL QUALITY MANAGEMENT

Introduction: BUSINESS EVOLUTION

Developing a Unique Organizational Capability: Four Practical Revolutions in Management, Evolution of Our Understanding, Four Levels of Practice

The First Revolution: CUSTOMER FOCUS

Change in the Work Concept: Market-in, Customers, Philosophy-in and Philosophy-out
Evolution of Customer Focus and Its Challenges: Three Stages of Customer Focus, Customer Concerns, Integration of Concerns, Individualizing Customers

The Second Revolution: CONTINUOUS IMPROVEMENT

Improvement as a Problem-Solving Process: Management by Process, WV Model of Continuous Improvement, Continuous Improvement of Processes for All Types of Work, Continuous Improvement and the Scientific Method

Managing Existing Processes

Process Discovery and Management: Thinking In Terms of Process, Process Discovery
Process Control and Variation: A Typical Example of (Mishandling) Variation, Making the Most of Variation, Process Control and Process Improvement
Reactive Improvement and the 7 Steps Method; Identifying the Problem, Standard Steps and Tools, The 7 Steps: A Case Study, The 7 QC Tools
Management Diagnosis of the 7 Steps of Reactive Improvement: General Guidelines for Managers Diagnosing a QI Story, Step-by-Step Guidelines for Managers Diagnosing a QI Story, Case Study for Diagnosis of the 7 Steps, Run PDCA and Develop Skill
Planning Projects or Tasks: The 9 Steps Compared with the 7 Steps, The 9 Steps Mobilization at Teradyne, A Teradyne Illustration of the 9 Steps Use, Relationship of the 9 Steps to Other Methods

Proactive Improvement: Collecting Data for Proactive Improvement, Language Data and Use of Semantics, Toward Standard Tools and Steps for Proactive Improvement, Customer Visititation as a Method of Collecting Proactive Improvement Data
Applying Proactive Improvement to Develop New Products; Develop Understanding of Customers’ Needs and Environment, Convert Understanding Into Requirements, Operationally Define Requirements for Downstream Development, Generating Concepts and Selecting the Concept, Expanding View of WV Model and Proactive Improvement

The Third Revolution: TOTAL PARTICIPATION
Engagement and Alignment of Organization Members : Engaged Employees for a Rapidly Changing World, Explicit Joining of Improvement and Routine Work, Processes and People
Coordinating Behavior; Societal Networking Case Study of the CQM Study Group on Conversation, Expansion of the Principles of Semantics, Some Types and Models of Conversations
Leading Change: Technical Skill, Human Skill, Conceptual Skill
Self-Development: Lessons from the Non-business World, Local Improvement in Absence of a Supportive Environment, The Bottom Line
Team Skill Development: Teamwork Skill, Some Fundamentals, Some Types of Teams substantially, Models for Team Development

Initiation Strategies; CEO Involvement, Case Study: Teradyne Strategy for Introduction
Infrastructure for Mobilization: Create Explicit Structures for Mobilization, A General Model for Mobilization: The 7 Infrastructures
Phase-In: Orientation Phase, Empowerment Phase, Alignment Phase, Evolution of the Parallel Organization, Common Patterns of Phase-In
U.S. Focused Strategies for Phase-In: Benchmarking, Six Sigma, Cycle-Time Reduction
Hoshin Management: Hoshin Management and Its Parts, Management by Objectives and Conventional Business Planning, Hoshin Management at Analog Devices
Leading Process Improvement: Modeling Personal Improvement, Employee Development at NIMS, Company Strategies, Individual Practice of CAPD by Managers’ case studies
The Practice of Breakthrough; Process versus Business Breakthrough, Case Studies and a Model of Business Breakthrough, Biggest Obstacle to Business Breakthrough, Integration of Ideas

The Fourth Revolution: SOCIETAL NETWORKING
Networking and Societal Diffusion: Regional and National Networking, The Japanese Model, Taking a Lesson from Japan—CQM, Comparison of National Methods, Use of Indirect Influence
Ongoing Integration of Methods: Applying Idealized Design to Hoshin Management, Structural Process Improvement Case Study, SerVend Case Study

Reference Books:
ELECTIVE II
NON-DESTRUCTIVE TESTING

<table>
<thead>
<tr>
<th>Sub Code</th>
<th>14 MPM 251</th>
<th>IA Marks</th>
<th>50</th>
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<tbody>
<tr>
<td>No. of Lecture Hrs/week</td>
<td>04</td>
<td>Exam Hours</td>
<td>03</td>
</tr>
<tr>
<td>Total Lecture Hrs</td>
<td>52</td>
<td>Exam Marks</td>
<td>100</td>
</tr>
</tbody>
</table>

**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 MPM 252
No. of Lecture Hrs/week : 04
Total Lecture Hrs : 52
IA Marks : 50
Exam Hours : 03
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, Aneleaing, 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>
<thead>
<tr>
<th>Sub Code</th>
<th>: 14 MPM 253</th>
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<tr>
<td>Total Lecture Hrs</td>
<td>: 52</td>
<td>Exam Marks : 100</td>
</tr>
</tbody>
</table>

**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 disadvantages.


**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
SIMULATION AND MODELING OF MANUFACTURING SYSTEMS

Sub Code: 14 MPM 254     IA Marks: 50
No. of Lecture Hrs/week: 04     Exam Hours: 03
Total Lecture Hrs: 52     Exam Marks: 100

**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, two 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:**

Laboratory Exercises
14 MPM 26

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.
6. Determination of cutting forces during milling using Milling tool dynamometer
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.
Distortion- methods to avoid distortion. Stresses in Joint Design.

Welding and Cladding of dissimilar materials, overlaying and surfacing.


Advanced soldering and Brazing processes different types.

Welding of plastics.

Inspection of Welds: Destructive techniques like Tensile, Bend, Nick break, Impact & Hardness. Non-Destructive techniques like ‘X’ rays, Ultrasonic, Magnetic particle, Dye Penetrant, Gamma ray inspection.

Welding Symbols- Need for, Representing the welds, Basic weld symbols, Location of Weld, Supplementary symbols, Dimensions of welds, Examples


Quality Control in Welding - Introduction, Quality assurance v/s Quality control, Weld quality, Discontinuities in welds, their causes and remedies and Quality conflicts.


REFERENCE BOOKS:

5. Welding for Engineers - Udin, Funk & Wulf
ELECTIVE III

INDUSTRIAL DESIGN AND ERGONOMICS

Sub Code: 14 MPM 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:

HUMAN RESOURCE MANAGEMENT

Sub Code : 14 MPM 422
IA Marks : 50
No. of Lecture Hrs/week : 04
Exam Hours : 03
Total Lecture Hrs : 52
Exam Marks : 100

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 check list, 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

REFERENCE BOOKS:
4. Human Resource Management - K. Ashwathappa,
ADVANCED FLUID POWER SYSTEMS

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

Sub Code : 14 MPM 424
IA Marks : 50
No. of Lecture Hrs/week : 04
Exam Hours : 03
Total Lecture Hrs : 52
Exam Marks : 100


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:

2. Handbook of Project Management - Dennis lock.
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: