M.Tech in Production Engineering  
With effect from 2009-2010 Academic Session

First Semester

<table>
<thead>
<tr>
<th>Theory</th>
<th>Contact Hours</th>
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<tbody>
<tr>
<td><strong>Professional Core</strong></td>
<td><strong>L-T-P</strong></td>
</tr>
<tr>
<td>1. Theory of Plastic Deformation</td>
<td>3-1-0</td>
</tr>
<tr>
<td>2. Production Technology</td>
<td>3-1-0</td>
</tr>
<tr>
<td>3. Quantitative Techniques in Production Management</td>
<td>3-1-0</td>
</tr>
<tr>
<td><strong>Professional Electives (Any Two)</strong></td>
<td>3-0-0</td>
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<tr>
<td>1. Advanced Decision Modeling Techniques</td>
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<tr>
<td>2. Quality Assurance</td>
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<tr>
<td>3. Product Design for Manufacturing</td>
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<tr>
<td>4. Rapid Prototyping and Tooling</td>
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<tr>
<td>5. Production Management</td>
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<table>
<thead>
<tr>
<th>Practicals/Sessionals</th>
<th>Contact Hours</th>
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<tbody>
<tr>
<td>1. Advance Production Engg. Lab-I</td>
<td>0-0-4</td>
</tr>
<tr>
<td>2. Pre-thesis work &amp; Seminar</td>
<td>0-0-3</td>
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Total 24 Credits

Second Semester

<table>
<thead>
<tr>
<th>Theory</th>
<th>Contact Hours</th>
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<tbody>
<tr>
<td><strong>Professional Core</strong></td>
<td><strong>L-T-P</strong></td>
</tr>
<tr>
<td>1. Computer Aided Design &amp; Computer Integrated Manufacturing</td>
<td>3-1-0</td>
</tr>
<tr>
<td>2. Non-Traditional Manufacturing Processes</td>
<td>3-1-0</td>
</tr>
<tr>
<td><strong>Professional Electives (Any Three)</strong></td>
<td>3-0-0</td>
</tr>
<tr>
<td>1. Composite Materials</td>
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<tr>
<td>2. Metal Forming Technology</td>
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<tr>
<td>3. Metrology</td>
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</tbody>
</table>
4. Robotics 
5. Maintenance Management and Reliability Engineering 
6. Quality Engineering 
7. IT in Manufacturing Enterprises 
8. Alternative Energy 

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<tr>
<th>Practicals/Sessionals</th>
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<tbody>
<tr>
<td></td>
<td>L-T-P</td>
</tr>
<tr>
<td>1. Advance Production Engg. Lab-II</td>
<td>0-0-4</td>
</tr>
<tr>
<td>2. Pre-thesis work &amp; Seminar</td>
<td>0-0-3</td>
</tr>
<tr>
<td>3. Comprehensive Viva-voce-I</td>
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Total 25 Credits 

Third Semester 

<table>
<thead>
<tr>
<th>Theory</th>
<th>Contact Hours</th>
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<tbody>
<tr>
<td>Open Elective (Any One)</td>
<td>L-T-P</td>
</tr>
<tr>
<td>1. Mechatronics</td>
<td>3-0-0</td>
</tr>
<tr>
<td>2. Engineering Tribology</td>
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<tr>
<td>3. Finite Element in Mechanical Systems</td>
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THESIS Part – I 14 Credit  
Total 17 Credits  

Fourth Semester 

<table>
<thead>
<tr>
<th>THESIS Part – II</th>
<th>Credits</th>
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<tbody>
<tr>
<td>Seminar</td>
<td>2</td>
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<tr>
<td>Comprehensive Viva-Voce-II</td>
<td>2</td>
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</table>

Total 24 Credits  

Grand Total = 90 Credits
Professional Core

Theory of plastic deformation
True stress-strain curve, Bauschinger effect, theory of plasticity, empirical equations to strain, strain curves, three dimensional stress and strain, invariants of stress and strain Yield criteria of metals, Treasca and Von Mises theory, Pandtl Reuss and Levy-Mises stress-strain relations work handling. Plastic instability application to rods in tension, thin walled pipes spherical shells subjected to internal pressure circular natural diaphragm. Equilibrium approach, concepts of friction in metal forming column friction and constants shear friction factor. Application of stress equilibrium approach to extrusion, drawing, rolling and forging, Discipline field theory, application to frictionless flat punch and wedge indentation, simple solution for frictionless extrusion and drawing. Upper and lower bound theorems, application plane-strain problems, simple indentation and extrusion using hodographs.

Text Books:
1. Plasticity for mechanical Engineering - Johnson, Von Nostrand. (Chap.1, 2, 4, 5, 10,12,13)

Reference Books:
1. An introduction to the principles of Metal working - Rowe, Edward Arnold, 1968
2. Metal forming processes and analysis - Avitzur, TMH, 1977

Production Technology
Foundry: Fluidity and factors effecting fluidity, Design of gating system, gases in metals and alloys, gas porosity and shrinkage phenomena in casting, direction solidification, risering of casting, riser design, mechanism of feeding, method of risering, feeding distance and feeder heads, use of padding, chills and fine inoculation of C.I., grain refinement principle, casting defects and their elimination.
Forging: classification, equipments, forging defects, forgability of steels
Rolling: Classification, rolling equipments, hot and cold rolling, rolling of bars and shapes, camber in rolling defects, variables in rolling
Extrusion: Classification, extrusion equipment, load displacement, characteristics, process variables and their optimization, different extrusion dies, extrusion defects, tube extrusion Hydrostatic extension, formality limit diagram.
Sheet metal forming: Formability of sheets, formability tests, principles of deep drawing, redrawing ironing and sinking, stretch forming, hydro-forming, spinning, bending, forming defects.
MEMS: Introduction, history, development, and need of micro-electro-mechanical systems, IC fabrication processes used for MEMS; Mechanical process techniques and process models for micromachining,
Introduction to nano-technology processes.

Text Books:
1. Fundamentals of metal casting technology - P.C. Mukherjee, Oxford and IBH. (Ch. 9,10,11,12)
2. Welding technology, R. Bittle, TMH. (Chap. 3 and 4)
3. Metallurgy of welding - W.H.Bruckner, Pitam. (Chap 1, 2, 10 and12)
4. Mechanical Metallurgy, Dieter, Me Graw Hill, Kogakusha. (Chap. 18, 19, 20 and 22)

**Reference Books :**
1. Casting properties of metals and alloys - V. Korolkove.
3. Manufacturing properties of materials - Campbell, TMH.

**Quantitative Techniques in Production Management**
Frequency distribution, measure and central tendency-comparing of mean, median and mode, Measuring variability, Probability-introductory ideas, probability distributions, Sampling and sampling distribution, estimation, testing hypothesis, chi-square and analysis of variance, Simple regression and correlation, multiple regression and modeling techniques, non-parametric methods, time series, Linear programming, Simplex method, Transportation problems, assignment problems.

**Text Book:**
Modern Production Management - Buffà, 5th Ed, John Wiley

**Computer Aided Design & Computer Integrated Manufacturing**
Introduction to CAD/CAM, representation of curves, surfaces and solids for CAD/CAM applications, computational geometry for manufacturing, product design for manufacture and assembly, computer aided process planning, computer aided assembly planning, computer aided inspection and reverse engineering, manufacturing processes simulation, virtual and distributed manufacturing, computer integrated manufacturing.

**Text Books:**
1. Automation, Production systems & Computer Integrated Manufacturing - M.P. Groover, PHI.
2. CAD, CAM & CIM - P.Radhakrishna and V.Raju, New Age International
Non-Traditional Machining


Reference Book

Professional Electives

Advanced Decision Modeling Technique


Text Book:
1. Operations Research - Fredrick S. Hillter and Gerald J. Liebumana, 2nd Ed. (Chap. 5, 6, 7, 14, 15,16, 17 and 18)

Quality Assurance

Introduction to quality assurance and quality control, various elements in Quality assurance program, On-line and Off-line quality control, Statistical concepts in quality, Probability distributions, Central limit theorem, Chance and assignable causes of quality variation, Process control charts for variables, Control chart parameters, Target process setting / centering, Control limits and specification limits. Process capability studies, Capability indices, Quality remedial / Corrective actions, Special purpose control charts, Reject limits, Variables inspection and attributes inspection, control charts for attributes,
Narrow limit gauging, Quality rating, Defects classification, Average run length, sensitivity of control charts. Sampling inspection for product acceptance, single, double, multiple and sequential sampling schemes, OC, AOQ, ASN, and ATI curves, Design of sampling plants, standard sampling systems, economics of product inspection, quality costs, ISO 9000 quality system, product quality and reliability, failure data analysis and life testing, problems and illustrations in quality assurance.

Reference Books

Product Design and Manufacturing

Engineering materials, metals and their properties, uses, processing methods, design data and applications, selection criteria, manufacturing and processing limitations, comparative studies; plastics and composites, types, classifications, properties, processing techniques and limitation, selection of plastics for specific applications, finishing and surface coating of different materials. An overview of three stages of product design, generating and evaluating conceptual alternatives from manufacturing point of view, selection of material and processes, evaluating part configuration for manufacturability, evaluating parametric design for manufacturability, design for manufacture, influence of materials process and tooling on the design of components manufactured by metal casting, forming and joining, form design of components, recent developments in casting machining, forming and finishing, processing of polymers and ceramics, surface modification of materials, product design for manual assembly, product design for high-speed automatic assembly and product design for robot assembly.

Text Books:
3. Oswaid, P.F and Begeman, M., Manufacturing Process, John Willy, 1987

Rapid Prototyping and Tooling

Review of solid modeling techniques with comparison advantages and disadvantages, basic principal of RP processes, classification of RP processes various industrial RP systems like stereo lithography, fused deposition modeling, selective Laser Sintering, Laminated object manufacturing, 3D printing, Ballistic particle modeling etc, roll of rapid prototyping and rapid tooling in product development and simultaneous engineering. Process planning for rapid prototyping, STL file generation defects in STL files and repairing algorithm, slicing and various slicing procedures, accuracy issues in rapid prototyping, strength of RP parts, surface roughness problem in rapid prototyping, part deposition orientation and issues like accuracy, surface finish, build time, support
structure, cost etc, rapid tooling techniques such as laminated metallic tooling, direct metal laser sintering, vacuum casting. Introduction to reverse engineering, integration of reverse engineering and rapid prototyping.

**Text Book:**

**Reference Book**
   Publisher: Springer

**Production Management**

Introduction to Production Management: Role of production/operation management, Decision making in production/operation management cost models. Analytical methods: System concepts-analytical methods in production/ operation. Design of Production System: Design of production and services distribution and facility location processes and job design layout of physical facilities line. Production planning and control: Demand for casting and operation-aggregate planning.

**Text Book:**
1. Modern Production Management - Buffa, 5th Ed, John Wiley

**Composite Materials**


**Text Books:**

**Metal Forming Technology**

Technological advances in metal forming process- forging, rolling, extrusion, wiredrawing and sheet metal forming, design of roll pass and rolling schedules,
description of typical cold rolling and hot rolling mill plants computer aided die design for forging, extrusion and wiredrawing, automation in metal forming processes, recent development in forming equipment(high speed presses etc) advances in sheet metal forming, sheet metal die design, formability evaluation, unconventional forming process like hydrostatic extrusion, high energy rate forming process, hydro forming of sheets and tubes, power forming, finite element simulation of forming processes.

**Text Books**

**Reference Books**

**Metrology**
Introduction to dimensional metrology, limits, fits and tolerances, application of tolerances, limit gauging, design of gauges, measuring instruments, comparators and their design considerations, angular measurements, auto collimators and interferometers. Applications of dimensional inspection, measurement of screw threads, thread Gauges for internal and external threads, gear inspection, inspection of surface quality, parameters for assessing surface finish and experimental methods of surface finish measurement, feature inspection, straightness, flatness, parallelism, squareness, circularity and roundness, automated dimensional measurements, automatic gauging, automatic measuring machines for inspecting multiple work piece dimensions, measurement with coordinate measuring machines.

**Text Books**

**Reference Books**

**Robotics**
parallel robots based on singularity, workspace, manipulability, dexterity, etc. Mechanical design of robot links and joints. Introduction to control of robotic systems

**Text Books:**
1. Robotic technology and flexible automation - S.R Deb, TMH.
4. Robots manufacturing and application - Paul Afnih, John Wiley.

**Maintenance Management and Reliability Engineering**

Concept of Reliability, Reliability data and analysis, Reliability & quality. Life testing, Accurate life testing. Maintainability and availability cost analysis, Replacement policies, types of maintenance, objective and function of maintenance organization. Simulation and reliability predication, Silcon reliability modeling modules. Reliability management, Integrated logistic support life cycle cost.

**Text Books:**
2. Maintenance planning and control - Anthony Kelly, EWP.
5. The Assurance Science - S. Halperu, PHI.

**Quality Engineering**

Statistics: Statistical methods, important statistical distributions and their properties, correlation and regression, multiple regression analysis, statistical interference, t-test, F-test, Chi-square test, ANOVA, DOE and RSM, Time series analysis.

Quality Engineering: Taguchi’s quadratic Loss function, offline and online quality control, importance of parameter design experimental design principles of product and process design, two-level experimental for full factorial and fractional factorial design, S/N ratio, inner and outer arrays, experimental design for control and noise factors, ANOVA in engineering design, computer software in experimental design, components of TQM, PDCA cycle, TQM implementation, quality cost, Ishiwaka diagram, brain storming, QCS, QFD, JIT philosophy and techniques, characteristic features and clauses of ISO 9000 standards, certification procedures, implementation procedures.

**Text Books:**
1. Statistics for engineering and science by Freund and Miller, PHI
2. Quality Engineering using Robust design by Ms Phadke, Prentice Hall
3. Total quality control essentials by Sarv, singh Soin, McGraw Hill Inc.93 Singapore
IT in Manufacturing Enterprises

Production systems, manufacturing enterprises as systems, appreciate the evolving manufacturing environment and multi attributed computation: IT role challenges and opportunities, evolving role of information technology in enterprises: P and I implications, technology management challenges, technical fundamentals: MIS in manufacturing enterprises, FMS (Flexible Manufacturing Systems) CIM systems, intelligent manufacturing systems, concurrent engineering and extended enterprises, ERP (enterprise resource planning), E-business and supply chain management, discreet event simulation and AI application in manufacturing enterprises, implementation issues, future trends, carriers etc.

Text Book
1. Textbook of Manufacturing Technology Manufacturing processes by Rajput Rk (Paperback - 2007)

Reference Book

Alternative Energy


Text Books:

Reference Books:
Open Electives

Mechatronics

**Hardware of Measurement Systems:** A review of Displacement, Position Velocity, Motion, Force, Fluid Pressure, Liquid Flow, Liquid Level, Temperature, Light Sensors / alongwith Performance Terminology; Selection of Sensors; Input Data by Switches; Signal Conditioning; Brief Review of Operational Amplifier & Digital logics, design of PWM controller; Protection; Filtering; Wheat Stone Bridge; Digital Signals; Multiplexers; Data Acquisition; Digital Signal Processing; Pulse Modulation; Data Presentation Systems – Displays; Data Presentation Elements; Magnetic Recording; Data Acquisition Systems; Testing & Calibration; Problems. **Design and Mechatronics:** Design Process; Traditional and Mechatronics Design; Possible Mechatronics design solutions for Timed Switch, Wind Screen Wiper Motion, Bath Room Scale, A Pick & Place Robot, Automatic Camera, Bar Code Recorder.

**Text Books:**

Engineering Tribology


**Text Books:**
2. Basic Lubrication – Brewer, Prentice Reinhold, Chap.5.7.8.9.
4. Lubrication Engineering – B.C.Majumdar

Finite Element in Mechanical Systems


**Text Books:**
2. Introduction to finite element methods - Abel & Desai, EWP.

Reference Books:

Human Resource Management


Text Books:
1. Human Resources Management by Wendell L. French, Hardcover: 726 pages, Publisher: Houghton Mifflin Company

Reference Books:
1. International Human Resource Management: Managing People in a Multinational Context by Peter Dowling, Denice E. Welch, Randall S. Schuler, Paperback: 324 pages, Publisher: South-Western College
2. 

Practicals/ Sessionals

Advanced Production Engineering Laboratory-I

1. Exercise in computer aided drafting and design, mesh generation, modeling, use of packages
2. Surface flatness measurement using slip gauges
3. Experiments on CAM using CNC Miller
4. Use of Autocollimater
5. Study of various machine tools their operational details and attachments

Advanced Production Engineering Laboratory-II

1. Study of the chip formation in turning process
2. Study of operation of tool and cutter grinder, twist drill grinder, centreless grinder
3. Determination of cutting forces in turning;
4. Determination of cutting forces in drilling
5. Inspection of parts using CMM
6. Experiments and demonstration of EDM
7. Experiments on surface technology.
8. Operation of FMS