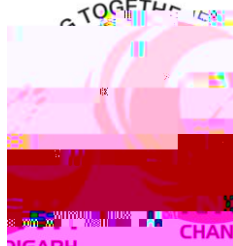# SYLLABI

and

SCHEME OF TEACHING

MASTER OF ENGINEERING

IN

MECHANICAL ENGINEERING

(MANUFACTURING TECHNOLOGY)

REGULAR &MODULAR PROGRAMME

(2024 – 2026)

MECHANICAL ENGINEERING DEPARTMENT

NATIONAL INSTITUTE OF TECHNICAL TEACHERS TRAINING & RESEARCH

CHANDIGARH

December 2023

FOURTH SEMESTER

CODE   SUBJECT

MMT-601: MANUFACTURING TECHNOLOGY – I

MMT-602: COMPUTER BASED PRODUCTION MANAGEMENT

Maximum marks: 50   **L**   **P**

Time Allowed: 3 hours   **4**   **--**

Rationale: Due to automation, there is a need to computerize the entire gamut of production activities both direct and indirect on the shop floor. The latest production management techniques of this subject will definitely help the manufacturing technologist to understand all the aspects of production planning and control.

DETAILED CONTENTS

PART – A

1.   Production Planning and Control   **(4 hrs)**

    1.1   Traditional PPC and its problems

    1.2   Symptoms of poor PPC system

    1.3   Operating priorities and principles

    1.4   Computer-integrated production management system, its need and requirement

    1.5   Use of computers in planning activities

    1.6   Cost planning and control

2.   Forecasting   **(4 hrs)**

    2.1   Characteristics of a good forecasting system.

    2.2   Various models and their selection: Qualitative and Quantitative

    2.3   Benefits of forecasting

3.   Aggregate Planning   **(4 hrs)**

    3.1   Performance measures: CPR and PPR

    3.2   Qualitative and quantitative methods

4.   Master Production Scheduling   **(4 hrs)**

    4.1   Types of scheduling and need for re-scheduling

    4.2   Cut and Fit method

5.   Capacity planning   **(4 hrs)**

    5.1   Need for capacity planning

    5.2   Strategies for modifying capacity

    5.3   Capacity planning modeling: Short term and long term

PART – B

6.   Manufacturing Resource Planning   **(10 hrs)**

    6.1   Importance of Inventory and inventory management

    6.2   Inventory management systems

    6.3   Material Requirement Planning (MRP)

    6.4   Working and benefits of different types of inventory system

    6.5   Performance measures

    6.6   Lot sizing methods

    6.7   Difference between MRP and MRP-II

6.

MMT-603: ADVANCED MANUFACTURING METHODS

Maximum marks: 50   **L**   **P**

Time Allowed: 3 hours   **4**   **--**

Rationale: The knowledge of this subject is required for precision machining of hard and tough materials. With the advent of new materials Manufacturing Technologist is facing many challenges to cut materials. This subject will equip him to solve such challenging situations.

DETAILED CONTENTS

PART – A

1.   Introduction to New Technology   **(6 hrs)**

    1.1   Need for New Technology

    1.2   Classification of New Technology

    1.3   Historical Background of New Technological Processes

    1.4   Definitions and Applications of Various Processes

    1.5   Comparative Analysis of Various New Technological Processes.

2.   Mechanical Processes   **(8 hrs)**

    2.1   Abrasive Jet Machining

        2.1.1   Fundamental Principles

        2.1.2   Application Possibilities

        2.1.3   Process Parameters.

        2.1.4   Schematic Layout of Machine Tool

    2.2   Ultrasonic Machining

        2.2.1   Range and Application Possibilities of Ultra-sonic Machining

        2.2.2   Fundamental Principles

        2.2.3   Process Parameters

        2.2.4   Slurry and Selection of Abrasive

        2.2.5   Tool Design

        2.2.6   Tool Feeding Mechanism

        2.2.7   Transducers

        2.2.8   Analysis for Metal Removal Rate

        2.2.9   Design of Horn (Velocity Transformer)

        2.2.10 Analysis of Process Parameters

3.   Chemical Machining   **(4 hrs)**

    3.1   Fundamental principles

    3.2   Process Parameters

    3.3   Classification and Selection of Material

    3.4   Selection of etchants

4.   Electro-Chemical Processes   **(10 hrs)**

    4.1   Electro-Chemical Machining

        4.1.1   ECM Process

        4.1.2   Fundamental Principles of ECM

        4.1.3   Classification of ECM Processes

MMT-604: INDUSTRIAL AUTOMATION AND CONTROL

Maximum marks: 50   **L   P**

Time Allowed: 3 hours   **4   --**

Rationale: Industrial automation is widely employed now-a-days, using pneumatic, hydraulic, electrical, electronics and computer systems. The modern engineering is incomplete without the knowledge of automation and control systems.

DETAILED CONTENTS

PART – A

1.

1.

6.4. Microcontrollers

7. Industrial Robotics (6 hrs)

7.1. Classification and Basic Motions

7.2. Components   Joints, Links, Sensors, Actuators

7.3. Forward and Inverse Position Analyses

7.4. Robot Languages & Programming

7.5. Robot Applications

BOOKS:

1. David G. Alciatore, Michael B. Histand, Introduction to Mechatronics and Measurement Systems   Tata McGraw Hill, 4th Edition, 2014

2.   cation, 4th Edition, 2014

3.

4.   10

5.   omputer Aided Manufacturing
   Pearson Education, New Delhi, 2015

6. S K Saha   McGraw Hill Education (India), 2016

MMT-605: MANUFACTURING TECHNOLOGY – II

Maximum marks: 50   **L**   **P**

Time Allowed: 3 hours   **4**   **--**

Rationale: The Manufacturing Technologist must be endowed with the knowledge   of different metal cutting processes and should have a thorough knowledge of tooling required to carry those processes. He should be able to analyze these processes for efficient production work.

DETAILED CONTENTS

PART – A

1   Introduction   (4 hrs)

    1.1.   Machining Fundamentals

    1.2.   Work-Tool Contact

    1.3.   Machineable Surfaces

    1.4.   Kinematics of Work-Tool Interaction

    1.5.   Kinematic Elements in Metal Cutting Action

2   Cutting Tools   (6 hrs)

    2.1   Tool angle specification systems

    2.2   Geometry of Single-Point Turning Tools

    2.3   Interrelation between Different Systems of Rake Angle

    2.4   Determination of Normal Rake Angle

    2.5   Effective Rake in the Direction of Chip Flow

    2.6   Geometry of Twist Drills

    2.7   Geometry of Plain Milling Cutter

3   Mechanism of Chip Formation   (6 hrs)

    3.1   Chip Formation Process

    3.2   Classification of Chips

    3.3   Mechanics of Chip Curl

    3.4   Chip Formation Analysis

    3.5   Chip Formation Process in Drilling

    3.6   Chip Formation in Milling Process

    3.7   Mathematical Modeling of the Sources of Heat in affecting Rise Temperature

    3.8   Average Chip Tool Interface Temperature

    3.9   Distribution of Temperature at Chip Tool Interface

    3.10   Experimental Determination of Chip Tool Interface Temperatures

4   Mechanics of Metal Cutting   (8 hrs)

    4.1   Forces of Deformation at the Cutting Edge

    4.2   Forces in Turning

    4.3   Energy of cutting Process

    4.4   Effect of Nose Radius

    4.5   Force Analysis during Oblique Cutting

    4.6   Forces in Drilling Process

    4.7   Force System in Milling Process

5	**Measurement of Cutting Forces**	**(6 hrs)**
	5.1 Measurement of Forces	
	5.2 Transducers for Force Measurement	
	5.3 Design Requirements of Dynamometers	
	5.4 Dynamics of Dynamometers	
	5.5 Dynamometers for measuring Forces in Turning Process	
	5.6 Drill Dynamometers	
	5.7 Milling and Grinding Dynamometers	

6   **Failure of Cutting Tools**   **(6 hrs)**
- 6.1 Tool Failure
- 6.2 Wear of Cutting Tools
- 6.3 Effect of Mechanical Properties of Work Materials
- 6.4 Effect of Tool Material
- 6.5 Effect of Nose Radius
- 6.6 Optimisation of Tool Geometry from Tool Life Consideration
- 6.7 Selection of Cutting Conditions
- 6.8 Experimental Evaluation of Taylor Exponent

7   **Economics of Machining**   **(6 hrs)**
- 7.1
- 7.2 Optimisation for Maximum Production and maximum profit
- 7.3 Generalised Analysis for Optimization of Cutting Conditions
- 7.4 Constraint in optimization
- 7.5 Selection of Optimum Cutting Parameters under Various Conditions

8   **Future trends in machine tools**   **(6 hrs)**
- 8.1. Aims and trends of future development
- 8.2. Design for improved static and dynamic performance
- 8.3. Manufacturing systems concept
- 8.4. Surface Integrity
- 8.5. Ultra precision Machining
- 8.6. Hard Turning

BOOKS:

1.
2.
    Age International (P) Ltd., Publishers, New Delhi, Reprint, 2008.
3.   turing Technology
4.
5.
6.   Serope Kalpakjia
    Prentice Hall, 2013

MMT-606

	7.2	Effect on Environment
	7.3	Life
	7.4	Reliability
	7.5	Safety
	7.6	Protection From Foreign Bodies
	7.7	Standardization
	7.8	Assembly
	7.9	Maintenance
	7.10	Costs
	7.11	Quantity
	7.12	Legal Matters
	7.13	Patents
	7.14	Appearance
	7.15	Materials and Manufacturing Processes
	7.16	Energy considerations

8. Decision Making in Design (4 hrs)

8.1 Decision Matrix

8.2 Decision Trees

8.3 Optimization methods   Search techniques, Linear Programming and Geometric Programming

9. Effect of Material Properties on Design (8 hrs)

9.1 Stress concentration

MMT-607: TOOL ENGINEERING

Maximum marks: 50   **L   P**

Time Allowed: 3 hours   **4   --**

Rationale: Any manufacturing activity needs the design of tools hence all Manufacturing Technologists need knowledge of this subject for

6.2. Rapid Prototyping   Principles and Classification:

6.3. Steps in Additive Manufacturing

6.4. Benefits and Applications

7. **Cloud Based Design & Manufacturing**   **(8 hrs)**

7.1. Internet of Things

7.2. Data Storage and Analytics

7.3. Cloud computing

7.4. Networked manufacturing

BOOKS:

1. Groover M. P. and Zimmers E. W.   omputer Aided Design and Manufacturing   Pearson Education, New Delhi, 2003

2.   omputer Aided Manufacturing   Pearson Education, New Delhi, 2015

3. P. Radhakrishnan, S. Subramanyan, V. Raju   New Age International, 2008

4. C.K. Chua, K.F. Leong, C.S. Lim, Rapid Prototyping: Principles And Applications   3rd Edition, World Scientific Publishing Co Pte Ltd,2008

5.   Apress, 2016

REFERENCE BOOKS

6. Alp Ustundag,Emre Cevikcan, Industry 4.0: Managing The Digital Transformation   Springer Series in Advanced Manufacturing, 2017

7. Zude Zhou, Shane Shengquan Xie, Dejun Chen, Fundamentals of Digital Manufacturing Science   Springer Series in Advanced Manufacturing, 2011

MMT-701: MANUFACTURING LAB –I

L   P

--   4

Note: The internal evaluation of the work done by the student will be based on a file documenting the practical work carried out during the course followed by a viva-voce examination.

PRACTICE TASKS

1.   Study of rolling and forging processes.
2.   Effect of draw force on wire diameter.
3.   Study of any one RPT process in an industry.
4.   Metal Removal Rate and Tool wear studies in Spark Erosion Machining.
5.   Study of process parameters in Electro-Chemical Machining.
6.   Functioning of hydraulic/pneumatic actuators and valves.
7.   Automation exercises on Ladder logic programming of PLCs.
8.   Control of an articulated robot using teach-pendent and programming.

MMT-702: MANUFACTURING LAB –II

L   **P**

--   **4**

Note: The internal evaluation of the work done by the student will be based on a file documenting the practical work carried out during the course followed by a viva-voce examination.

PRACTICE TASKS

1. Study of chip formation during turning, milling and drilling processes.
2. Study of different types of dynamometers and their usage.
3. Measurement of surface roughness of machined surfaces.
4. Gauge design for an industrial component.
5. Design of a drill jig.
6. Operation and programming of CNC machine.
7. Study and programming of an FMS.
8. 3D printing of a component from its CAD model.

MMT-

5.   Applications of MATLAB/Simulink   (8 hrs)
    5.1   Matrix creation and manipulation
    5.2   Plotting and curve fitting
    5.3   Solving Tool-Life equation
    5.4   Search techniques and linear programming
    5.5   Modeling and simulating machine scheduling problems
    5.6   Modeling and simulation of first order and second order dynamic systems

BOOKS:
1.   Getting Started with MATLAB
2.
3.   MATLAB f
        Learning, 2004.
4.   MATLAB
        2012

MMT-652: COMPUTER AIDED DESIGN FOR MANUFACTURING

Maximum marks: 50   **L   P**
Time Allowed: 3 hours

2.   omputer Aided Manufacturing
Pearson Education, New Delhi, 2015
3.   Ibrahim Zeid, R Sivasubramanian   /CAM   -McGraw Hill
Ltd., New Delhi, 2009
4.   Moaveni   w
Education, 2011

5.

MMT-653: INDUSTRIAL INSTRUMENTATION

Maximum marks: 50   **L**   **P**

Time Allowed: 3 hours   **4**   **--**

Rationale: The Manufacturing Technologist must be endowed with the knowledge of instrumentation in order to monitor and control the manufacturing process. This subject will help him in the selection and use of measuring instruments.

DETAILED CONTENTS

PART – A

1	**Fundamental Concepts**	**(4 hrs)**
	1.1 Applications of the Instrument Systems	
	1.2 Functional Elements of a Measurement System	
	1.3 Classification of Instruments	
	1.4 Standards and Calibration	
2	**Static and Dynamic Characteristics of Instruments**	**(6 hrs)**
	2.1 Static and dynamic characteristics	
	2.2 Errors	
	2.3 Static Performance Parameters	
	2.4 Formulation of System Equations	
	2.5 Dynamic Response	
	2.6 Compensation	
3	**Elements of Instrumentation System**	**(10 hrs)**
	3.1 Analog and Digital Transducers	
	3.2 Operational Amplifiers	

6   Pressure Measurements   **(4 hrs)**

    6.1   Moderate and High Pressure Measurement

    6.2   Low Pressure (Vacuum) Measurement

7   Temperature Measurements   **(4 hrs)**

    7.1   Electrical and Non-electrical Methods

    7.2   Radiation Methods (Pyrometery)

8   Flow Measurements   **(4 hrs)**

    8.1   Primary or Quantity Meters

    8.2   Secondary or Rate Meters

9   Condition Monitoring   **(6 hrs)**

    9.1   Vibration and Noise Monitoring

    9.2   Temperature Monitoring

    9.3   Wear Behaviour Monitoring

    9.4   Corrosion Monitoring

    9.5   Performance Trend Monitoring

    9.6   Selection of Condition Monitoring Techniques

BOOKS:

1.

2.   Doebelin E. O.,

3.

MMT-654: WELDING TECHNOLOGY

5.2 Soldering

5.3 Adhesive bonding

5.4 Mechanical fastening

5.5 Joining plastics

6.   Welding Practices   (8 hrs)

6.1 Plasma arc welding

6.2 Submerged arc welding

6.3 Welding of materials like aluminium, copper, steel

6.4 BIS code on welding

6.5 Inspection of welds and welded joints

6.6 Welded defects & their causes

BOOKS:

1.
    Prentice Hall, Fifth edition, 2002.
2.   lhi, 2005.
3.
4.   R. L. Agarwal   , Khanna Publishers, Delhi, 2011.
5.   O.P.
6.   Raymond J. S   Practice of A   New York, D. Van Nostrand Co.,
    1960.

MMT-655: OPTIMIZATION TECHNIQUES

Maximum marks: 50   **L** **P**
Time Allowed: 3 hours   **4** **--**

5.4 Direct Search for Constrained Minimization : Variable elimination, Complex search and Random search methods.

5.5 Linearized Search Techniques: Frank-Wolfe method, Cutting plane method, Feasible Direction Method, Generalized Reduced Gradient Method, Gradient Projection Method.

BOOKS:

1.

2.

Edition, 2009

3.

4. Deb Kalyanmoy,
Prentice Hall of India, New Delhi, 2005

5. Belegundu,Chandragupta
Pearson, 2003

MMT-656: INDUSTRIAL PROJECT MANAGEMENT

Maximum marks: 50

Time Allowed: 3 hours

L   **P**

6.4

MMT-657: RESEARCH METHODOLOGY

Maximum marks: 50   **L**   **P**

Time Allowed: 3 hours   **4**   **--**

Rationale: The subject of research methodology covers the concepts and applications of tools useful for conducting research in a scientific manner. Therefore this subject is relevant for the tools

PART – B

6. **Procedure of data collection** **(4 hrs)**
- 6.1 Aspects of data collection
- 6.2 Techniques of data Collection

7. **Statistical Methods of Analysis** **(4 hrs)**
- 7.1 Descriptive statistics
  - 7.1.1 Meaning
  - 7.1.2 Graphical representations
  - 7.1.3 Mean, range and standard deviation
- 7.2 Characteristics and uses of normal curve.

8. **Inferential Statistics** **(8 hrs)**
- 8.1 T-test
- 8.2 Chi-

MMT-658: TECHNOLOGY MANAGEMENT

Maximum marks: 50　　　　　　　　　　　　　　　　　　　　　**L**　　　**P**

Time Allowed: 3 hours

4. Moulding And Casting Processes (8 hrs)

    4.1. Hot box, cold box process

    4.2. Investment casting, shellmoulding, full mould process

    4.3. D