Savitribai Phule Pune University, Pune
Ganeshkhind, Pune-411007 (MS) India

Skill Development Centre (SDC),

Bachelor of Vocation
(B. Voc.)

Course Structure

(Framed as per National Educational Policy 2020)

For
Manufacturing Skills
(Semester - V and VI)

(Effective from June 2025 and onwards)

Semester – V

Subject Code	Course Name	Course Type	Type of Course	Credits	Total Hrs	Internal Marks	External Marks	Total
MS - 301- MJ	Principles of Management	Department Specific Core-	Theory	2	30	25	25	50
MS - 302- MJ	Work system Design	Department Specific Core	Theory	2	45	25	25	50
MS - 303- MJ	Process Engineering	Department Specific Core	Theory	2	30	25	25	50
MS - 304- MJP	Workshop Practices	Department Specific Core-	Practical	2	45	25	25	50
MS - 305- MJP	Practical's on Theory	Department Specific Core	Practical	2	45	25	25	50
MS - 310- MJ	Quality Engineering	Department Specific Major elective	Theory	2	45	25	25	50
MS- 311- MJP	Manufacturing and Quality - I	Department Specific Major elective	Practical	2	30	25	25	50
MS - 321- VSC	Computer Application for Manufacturing Automation	Vocational Skills Course (Dept Subject based on Major & Minor)	Practical	2	60	25	25	50
MS - 331-FP	OJT On Job Training	Department Specific Core	Practical	2	30	25	25	50
MS - 341- MN	Robotics I	Department Specific Minor Theory	Theory	2	30	25	25	50
MS - 342- MNP	Robotics Lab	Department Specific Minor Practical	Practical	2	30	25	25	50
Total				22 Credits	420	275	275	550

Semester –VI

Subject Code	Course Name	Course Type	Type of Course	Credits	Total Hrs	Internal Marks	External Marks	Total
MS-351-MJ	Production and Operation Management	Department Specific Core-	Theory	2	30	25	25	50
MS -352-MJ	Quality Management	Department Specific Core-	Theory	2	45	25	25	50
MS -353-MJ	Advanced Manufacturing Technology	Department Specific Core	Theory	2	45	25	25	50
MS -354-MJP	Automation Practical's	Department Specific Core-	Practical	1+1	45	25	25	50
MS -355-MJP	Work shop Practices II	Department Specific Core	Practical	1+1	45	25	25	50
MS -360 MN	Workplace Management & 5S Activities	Department Specific Major Elective Theory	Theory	2	30	25	25	50
MS -361-MNP	Workplace Management & 5S Activities Lab	Department Specific Major Elective Practical	Practical	2	30	25	25	50
MS -381-OJT	OJT (On Job Training)	Department Specific Core	Practical	2	30	25	25	50
MS -382-OJT	OJT (On Job Training)	Department Specific Core	Practical	2	30	25	25	50
MS-391-MN	Industrial Safety	Department Specific Core Minor Theory	Theory	2	60	25	25	50
MS -392-MNP	Industrial Safety Practical's	Department Specific Core Minor Practical's	Practical	2	30	25	25	50
Total				22 Credits	420	275	275	550

MS -301-MJ Principles of Management

Marks : 50 **Credits : 2**

Contact Hrs : 30

Chapter - 1: Introduction to Management Concepts 6 Hrs.

Introduction, Definitions of Management, Role of Management, Importance of Management,

Principles of Management, Characteristics of Management, Levels of Management, Functions of Management, Types of Planning, Types of Organizations, Managerial Skills and Functional Areas of Management.

Chapter - 2: Planning and Organizing 6 Hrs.

Planning Activities, Prescribing Standard Forms for various Activities, Budgeting for Materials, Budgeting for Manpower, Organizing the Physical Resourses, Matching Human Need with Job Needs, Allocation of Task, Relations between individuals working in team

Chapter - 3: Directing and Controlling 6 Hrs.

Needs for directions and instructions to the subordinates, completeness and feasibilities of instructions, Personal Counseling, Prediction of possible mistakes, Elaborating decisions, Disciplinary standards, Managerial Control, Steps in managerial control process, Controlling Methods, Measuring Performance

Chapter - 4: Industrial Safety Management 12 Hrs.

Need for Safety, Safety Management measures, General Industrial Safety Norms, Preventive Measures, Accidents – types and causes, Workplace safety, Fire safety, Electrical Safety, Safety procedures, Work permits, PPE, Industrial Safety standards.

Legislative Acts :Necessity of Acts, Importance and Provisions of various Industrial Acts – Indian Factory Act, Industrial Dispute Act, Workman Compensation Act, Minimum Wages Act

References:

1. Chaudhary Omvir, Singh Prakash, „Principles of Management", New Age International Publishers, New Delhi.

2. Dr. O P Khanna, „Industrial Engineering and Management", Dhanpat Ray and Sons, New Delhi.

3. Veerbhadrappa, Havinal, „Management and Entrepreneurship", New Age International Publishers, New Delhi.

4. Banga and Sharma, „Industrial Engineering and Management", Khanna Publication, New Delhi.

MS -310-MJ Quality Engineering

Marks : 50 **Credits : 2**

Contact Hrs. : 30

Syllabus:

1. **Introduction: 7 Hours**
   Different Definitions and Dimensions of Quality, Historical Perspective (From Evolution of Quality Control, Assurance and Management to Quality as Business Winning Strategy), Contribution of Renowned Quality Gurus (Their Philosophies and Impact on Quality) Gurus of TQM - Shewart, Ronald Fisher, Deming, Juran, Feigenbaum, Ishikawa, Crosby, Taguchi – TQM Framework – Obstacles, Benefits of TQM.

2. **Metrology, Measurement standards and comparators 9 Hours**
   Principles of Engineering metrology, Measurement standards, Types and sources of errors, Accuracy and Precision, introduction to uncertainty in measurement, linear and angular measuring instruments and their applications
   Calibration: Concept and procedure, traceability, Gauge R&R
   Comparators: Mechanical, Pneumatic, Optical, Electrical (LVDT). Checking all geometrical forms
   Design of Gauges: Tolerances, Limits and Fits, Taylor's principle, Types of gauges and gauge design.
   Interferometer: Principle, NPL Interferometer, Laser Interferometer and their applications.
   Surface Roughness Measurement: Surface texture, Parameters for measuring surface roughness, Contact & non-contact type surface roughness measuring instruments.
   Measurement of Thread form: Thread form errors, Measurement of Minor, Major and Effective diameter (Three Wire Method), Flank angle, pitch, Floating Carriage Micrometer.
   Gear Metrology: Types of errors, Gear tooth Vernier, Constant chord, Base tangent, Gear Rolling Tester. Profile Projector, Tool make's microscope and their applications.
   Advancements in Metrology: Introduction & applications of: Co-ordinate Measuring Machine, Universal Measuring Machine, Laser in Metrology, Automatic inspection system, Machine vision for online-offline inspection.

3. **Introduction to Quality and Quality Tools 7 hours**
   Quality: Dimensions, Statements, Cost of quality & value of quality, Deming's cycles & 14 Points, Juran Trilogy approach, Seven Quality Tools, Introduction to N Seven Tools, Quality Circle, Criteria for Quality Award (National & International), Introduction to National and International Quality Awards (Malcolm Baldrige National Quality Award – MBNQA, The Deming Prize Rajiv Gandhi National Quality Award.

4. **TQM Principles 7 hours**

Leadership, Customer Satisfaction, Employee Involvement, Continuous Process Improvement, Supplier Partnership, Performance Measures, Cost of Quality.

Total Quality Management: Basic Philosophy, Approach, Implementation Requirements & Barriers.

Reference Books

1. Hume K.J., Engineering Metrology, Macdonald Publications
2. Jain R.K., Engineering Metrology, Khanna Publication.
3. Juran J. M., Quality Handbook, McGraw Hill Publications.
4. Grant S.P., Statistical Quality Control, Tata McGraw hill Publication.
5. Kulkarni V. A. and Bewoor A. K., Quality Control, John Wiley Publication.
6. Galyer J.F & Shotbolt C.R., Metrology for engineers
7. Gupta I.C., Engineering Metrology, Dhanpatrai Publiartions
8. Judge A.W., Engineering Precision Measurements, Chapman and Hall
9. Francis T. Farago, Mark A. Curtis, Handbook of dimensional measurement.
10. ASTME, Handbook of Industrial Metrology, Prentice Hall of India Ltd.
11. Harrison M. Wordsworth, Stefeen Godfrey, Modern Methods for Quality control and Improvement, Willy publication.
12. Quality Assurance and Total Quality Management (ISO 9000, QS 9000 ISO 14000) by K C Jain and A K Chitale, Khanna Publishers
13. Quality Control & Application by B. L. Hanson & P. M. Ghare, Prentice Hall of India
14. The Asian Productivity Organization by Takashi Osada,1991
15. KAIZEN by Masaki Imami, Mc Graw Hill ,1986
16. Total Quality Management by Dale H. Besterfield, Carol Besterfield-Michna, Glen H. Besterfield and Mary Besterfield-Sacre, Pearson Educaiton
17. Quality Management by Kanishka Bedi
18. Total Quality Management – Dr. S. Kumar, Laxmi Publication Pvt. Ltd.
19. Total Quality Management by K C Arora, S K Kataria & Sons
20. Statistical Quality Control by M. Mahajan, Dhanpat Rai & Co. (P) Ltd.
21. The essence of total quality management by John Bank, PHI 2000

MS -302-MJ Work System Design

Marks : 50 **Credits : 2**

Contact Hrs : 30

Chapter - 1: Productivity **6 Hrs.**

Introduction of Work System Design, Introduction and Concept of Productivity, measurement of Productivity, Productivity Measures, Productivity Measurement Models, Factors Influencing Productivity, Causes of Low Productivity, Productivity Measurement Models,

Chapter - 2: Work Study and Method Study **6Hrs.**

Work Study: Basic Concept, Steps Involved in Work Study, Concept of Work Content, Techniques of Work Study, Human Aspects of Work Study
Method Study: Basic Concept, Steps Involved in Method Study, Recording Techniques, Operation Process Charts And Operation Process Charts: Examples

Chapter - 3: Flow Process Charts **6 Hrs.**

Flow Process Charts: Examples, Two-Handed-Process Charts, Multiple Activity Charts, Flow Diagrams. String Diagrams, Principles of Motion Economy, Micro-Motion Study, Therbligs, SIMO Charts, Memo-Motion Study, Cycle graph and Chrono-Cycle Graph, Critical Examination Techniques,

Chapter - 4: Work Measurement and Performance Rating **12 Hrs.**

Work Measurement: Basic Concept, Techniques of Work Measurement, Steps Involved in Time Study, Steps and Equipment's of Time Study.
Performance Rating: Examples, Allowances, Computation of Standard Time-I, Computation of Standard Time-II, Case Study
Work Sampling and Ergonomics: Work Sampling: Basics, Procedure of Work Sampling Study, and Numerical Problems on work sampling, Introduction to Synthetic Data and PMTS, Introduction to MTM and MOST Ergonomics: Basic Concept, Industrial Ergonomics.

References:

1. Introduction to Work Study: International Labor Office (ILO), Geneva.
2. Motion and Time Study Design and Measurement of Work: Ralph M. Barnes, Wiley, the University of California.
3. Industrial Engineering and Production Management: M. Telsang, S. Chand and Company Ltd.

MS -303-MJ Process Engineering

Marks : 50 **Credits : 2** **Contact Hrs. 30**

Syllabus:

1. Fundamentals of process control: **5 Hours**

Introduction to process control, open loop and closed loop systems Process parameters, Control systems parameters, Different controller modes.

2.Process Control Action: **12 Hours**

Elements of process control, Controller Principle, Process Characteristics, Control system parameters, discontinuous, continuous and composite controller modes/actions (P,I,D,PI,PD and PID), Study of electronic and pneumatic controllers, control loop characteristics, control system configuration, single variable ,multivariable, cascade controllers, feedback and feed forward controller.

3.Control Schemes: **8 Hours**

Feedback, feed forward, cascade, ratio, split range, selective control, adaptive control, and model-based control.

4.Process Controllers and Tuning: **5 Hours**

General features, construction and working of Pneumatic, Hydraulic and Electronic controller.

Reference Books:

1. P. W. Murrill, "Fundamentals of Process Control", International Society of Automation, 1st Edition, 2000.
2. P. W. Murrill, "Applications concepts of Process control", International Society of Automation, 3rd edition, 2012.
3. Krishna Kant, "Computer Based Industrial Control", Prentice hall of India, 2nd Edition, 2010.
4. Donald Eckman, "Automatic Process Control", Wiley Eastern Limited, 1st Edition, 1966
5. Thomas E Marlin, "Process Control - Designing processes and Control Systems for Dynamic Performance", McGraw-Hill International Editions,1st Edition,1995.
6. F. G. Shinskey, "Process control Systems", TATA MCGRAW HILL, 3rd Edition, 1988.
7. B Liptek, "Instrument engineers handbook", Chilton book Co, 1st Edition, 1969.
8. Stephanopoulos George, "Chemical Process Control", Prentice hall of India, United States Edition, 1983.
9. B. Wayne Bequette, "Process Control: Modeling, Design and Simulation", Prentice hall of india, 1st Edition, 2002.
10. Considine, "Process/Industrial Instruments and Controls Handbook", McGraw-Hill Professional, 5th Edition, 1999.
11. T. J. Ross, Fuzzy Logic with Engineering Applications, Wiley, 3rd Edition, 2011.
12. C.D. Johnson: Process control Instrumentation Technology.
13. N. A .Anderson: Instrumentation for process measurement and control.
14. Kuo: Automatic Control Systems.

MS -341-MN Robotics - I

Marks : 50 **Credits : 2** **Contact Hrs. : 30**

Syllabus:

1. Fundamentals of Robotics (6 Hours)

Introduction and classification of robots, Basics of matrices, Rotations and transformations, Introduction to D-H parameters and its physical significance, Orientation of Gripper, Trajectory planning. Need for automation, Robotics fundamentals, Classification of Robots based on co-ordinate system, Method of control, Major components of Robotics system, Fixed and flexible automation, Application of Robotics

2. Robotic Systems (12 Hours)

Mechanical system: Components of Robot-Manipulator, Controller, Sensors, Power conversion unit, Fundamentals of Pneumatic, Hydraulic and Electrical actuators used in Robots, Vision systems for Robot.

Motion conversion: Rotary to rotary, Rotary to Linear, Linkages, Modeling of Mechanical systems-Translational, Rotational, Kinematics' chain, Lagrangian analysis of manipulator, End effectors, Control of Robotic joints

Computer consideration for Robot system: Robot programming- Fixed instruction Sequence control, General programming language, Specific programming languages.

3. Robotics Sensors (6 Hours)

Basics of automation and electro mechanical control systems, Basics of different electrical Components, mechanical parts, electronic parts etc. Position Sensors, robot calibration by optical encoder, proximity sensors, Ultrasonic sensors, Force and Torque sensors, Touch and Slip sensors,

4. Actuators (6 Hours)

Specifications and characteristics of Stepper motors, AC motors, DC motors and servo motors, Motors

Reference Books:

1. R. J. Schilling: Fundamental of Robotics- Analysis and control
2. R. Jain, R. Kasturi and B. J. Shunck: Machine Vision
3. M. P. Groover: Automation, Production Systems And Computer Integrated Manufacturing
4. M. P. Groover, "Industrial Robotics - Technology - Programming and Applications", SIE
5. W. Bolton, "Mechatronics: Electronic Control Systems in Mechanical and Electrical Engineering", Pearson Publication, 2010.
6. W. Bolton, "Mechatronics: A Multidisciplinary Approach", Pearson Publication, 2014.
7. R Mittle, I Nagrath, "Robotics and Control" Mc-Graw Hill Education, 2017.

MS -342-MNP Robotics Practical's

Marks : 50 **Credits : 2** **Contact Hrs. : 30**

List of Practical's:

1. Aristo Robot safety precautions.
2. Aristo Robot mechanical interface.
3. Aristo Robot troubleshoot & Maintenance.
4. MRobot Operating procedures.
5. MRobot programming steps.
6. Aristo Robot Assembly picks and place operation.
7. Aristo Robot chuck open and close operation.
8. Aristo Robot vice loading and unloading operation.
9. Aristo Robot bearing shaft assembly operation.
10. Aristo Robot pressing the ON/Off button.

11.Study of classification of robots
12. Study of kinematics of robots
13. Programming techniques
14. Application of robot control aspects for various systems
15. Understanding of robots inter-joints, kinematics and controls methology
16. Demonstrate knowledge in control systems of robot
17. Demonstrate knowledge in operating industrial robot

MS -311-MJP Manufacturing and Quality - I

Marks : 50 **Credits : 2** **Contact Hrs. :30**

List of Practical's:

1. Assignment based on Management Concepts
2. Assignment based on Industrial Safety Management
3. Assignment based on Legislative Acts
4. Visit to manufacturing industry and prepare report
5. Assignments based on advanced manufacturing processes
6. Assignments based on CNC part programming
7. Assignments based on Inspection and Quality Control in Manufacturing
8. Assignments based on Non-destructive Inspection
9. Assignment based on Production and Operations Management
10. Assignments based on the risks identified

a. Identify activities which can cause potential injury, Inform the concerned authorities about the potential risks, machine breakdowns, damages etc.

b. Create awareness amongst other by sharing information on the identified risks

11. Assignments based on a Safe, clean and environment friendly work place

a. Equipment manual, Safety, Health and Environment related practices developed by the organization

b. Personal Protective Equipment"s (PPE), Maintain a clean and safe working environment near the work place, Personal hygiene, waste disposal.

12. Assignments based on proper sorting of items at the work place

a. recyclable materials, the technique of waste disposal and waste storage

b. segregate the items which are labeled at red tag items for the process area and keep them in the correct places

13. Assignments based on documentation, storage & organizing the workplace
14. Assignments based on cleaning of self and the work place
15. Assignments based on standardization

a. logical and user friendly documentation and file management for all activities across the plant and create guidelines around standardization of processes

b. timely creation and sharing of the 5s checklists

16. Assignments based on sustenance

a. audit of 5 s activities, continuous training on 5s

b. visual controls, notice boards, symbols etc are created, working and are put up

17. Assignments based on Inspection of final products

a. prepare a quality plan for product and process audit, roles and responsibilities of the QC inspectors

b. resolve the non-conformities in the product audit , process documentation : PFMEA/CP

18. Any other practical‟s / Assignments relevant to Syllabus (as per requirement)

MS -304-MJP Work shop Practices I Practical 1

Marks : 50 Credits : 2

Chapter 1 = Practical of General workshop safety.

1. Identify and explain about Safety Signs from an images or videos, Identify Unsafe Act, Unsafe Condition and Near Miss from an image or video, Identify and explain the Necessity of Personal Protective Equipment, Case based questions to identify Cause of Accident and precautionary measures. 2. Importance of First Aid. Identify the elements present in a first aid box and their usage. 3. Steps that are followed to eliminate different elements of the Fire Triangle. 4. Identify the types of fire extinguishers and their application on various types of fires. 5. Perform mock drill session in group of students for extinguishing fire

Chapter 2= Practical of Basic Workshop Process & Practice of Manufacturing Process.

1. How to use different types of hand tools - File,Hammere ,Spanner,allen key,srew driver,hacksaw,chisel etc 2. Prepare job with following operations: -Marking operation as per drawing -punching operation as per drawing -filing operation as per drawing -chamfering operation as per drawing -sawing operation as per drawing -drilling operation as per drawing 3. Tapping operation as per drawing - Marking operation as per drawing -punching operation as per drawing -filing operation as per drawing -chamfering operation as per drawing -sawing operation as per drawing -drilling operation as per drawing -tapping operation as per drawing 4. Prepare utility job(like stool, benches, tables or similar jobs) involving arc welding as per given drawing (in group of 4 to 5 students) -Fabrication operation involve measuring, marking, cutting, edge preparation, welding -Carpentry operation involve measuring, marking cutting and Assembly with fabrication part.

Reference Book

1. Workshop Practice, McGraw Hill Education,

2. A Textbook of Manufacturing Process(Workshop Tech.),S. .Chand and Co. New Delhi

3. Workshop Technology (Part I,II& III) - Chapma

MS -331-FP On-Job Training

Marks : 50 **Credits: 2**

Objective:

To enhance student employability and entrepreneurial potential by providing real-world industrial exposure through **On-Job Training (OJT)** in leading manufacturing industries.

Overview:

The **B.Voc. in Manufacturing Technology** program includes **compulsory On-Job Training (OJT)** as an essential part of the curriculum. This initiative aims to bridge the gap between classroom knowledge and industry practices by immersing students in actual manufacturing environments.

Key Features of OJT:

- Conducted in **leading manufacturing industries** across various domains.
- Scheduled as part of the **Second Semester curriculum**.
- Aims to provide **hands-on skills, industrial work culture experience**, and **real-time problem-solving exposure**.
- Helps students build **industry connections**, identify **career interests**, and develop **job-ready competencies**.

Student Responsibilities:

1. Participation:

- Students must actively engage in OJT, follow company policies, and demonstrate professionalism throughout the training period.

2. Report Submission:

- At the end of the Second Semester, students are required to submit an **OJT Report** which must include:
  - **Industry Details** (Name, Location, Type)
  - **Training Duration and Department**
  - **Work Assigned and Skills Learned**
  - **Technical Activities and Tools Used**
  - **Project or Task Contributions**
  - **Key Learning Outcomes and Achievements**
  - **Suggestions or Reflections**
- The report must be **duly certified** by the **competent authority from the industry** (Supervisor/Manager).

3. Presentation:

- Students must deliver a **presentation** based on their report, highlighting:
  - Major tasks undertaken
  - Skills acquired
  - Challenges faced and how they were handled
  - Learning impact on their career path
- The presentation will be evaluated by faculty members or a designated academic panel.

Evaluation Parameters:

Criteria	Marks
Participation and Industrial Behavior	10
Quality and Content of Report	20
Presentation and Communication	10
Learning and Skill Development	10
Total	**50**

Important Notes:

- OJT is **mandatory** for successful completion of the semester.
- Students must maintain a **logbook or diary** during training to record daily activities.
- Any misconduct or lack of attendance may lead to disqualification or re-training.

MS -321-VSC Computer Application for Manufacturing Automation – Practicals

Module 1: Introduction to CAD/CAM Tools

- **Experiment** : Introduction to CAD tools – Creating 2D and 3D models of mechanical parts
- **Experiment** : Importing CAD models into CAM software for machining simulation
- **Software**: AutoCAD, SolidWorks, Fusion 360, or similar

Module 2: CNC Programming and Simulation

- **Experiment** : Manual programming for CNC turning and milling
- **Experiment** : Simulating CNC programs using software like NC Viewer or Mach3
- **Experiment** : Post-processing G-code and running on virtual machine
- **Software**: G-Simple, CAMotics, CNC Simulator Pro

Module 3: PLC Programming for Industrial Automation

- **Experiment** : Basic ladder diagram programming – logic gates, timers, counters
- **Experiment** : Control of automated systems like conveyor belts or robotic arms
- **Experiment** : Virtual simulation of PLC logic using software
- **Software**: Siemens LOGO!Soft, Allen Bradley RSLogix, or Factory I/O

Module 4: Robotics and Automation Control

- **Experiment** : Introduction to robotic programming using simulation tools for Aristo Robo

Note * Addition or deletion of Experiment as per requirement

MS -351-MJ Production and Operations Management

Marks:50 **Credits:2**

Contact Hrs. : 30

Chapter - 1: Production Systems and Facility Planning **5 Hrs.**

Types of Production Systems, Productivity, Measurement of Productivity, Productivity Improvement, Plant Location, Factors Affecting Plant Location, Location Evaluation Methods, Facility Layout and Planning, Factors Influencing Plant Layout, Material Flow Patterns, Tools and Techniques used for Plant Layout Planning

Chapter - 2: Production Planning **5 Hrs.**

Production Planning and Control – definitions, functions and importance, Sales Forecasting - Forecasting System, Qualitative and Quantitative Methods of Forecasting, Process Planning - Aggregate Production Planning, Capacity Planning,

Chapter - 3: Production Control **8 Hrs.**

Production Control, Sequencing, Master Production Scheduling (MPS), Materials Management, Inventory Control, Economic Order Quantity (EOQ) Models, Production Quantity Model, Just in Time (JIT), Kanban System, Materials Requirement Planning (MRP), Enterprise Resource Planning (ERP), Concept of Quality, Total Quality Management (TQM), Total Productive Maintenance (TPM), Statistical Quality Control (SQC), Six Sigma

Chapter - 4: Operations Management **12 Hrs.**

Operations Management – Introduction, Objectives, Functions and Scope, Types of Production Systems, Operations Strategy Product Life – Cycle, Value Engineering Concepts, Design for X (DFX), Ergonomics in Product Design, Rapid Prototyping: Concept, Advantages

Project Management Systems--Project Scheduling, Network Diagrams, Critical Path Method (CPM), Program Evaluation and Review Technique (PERT), Time Cost Trade Off (Crashing), Project Network: Crashing Problems

References:

1. Operation Management: K. N. Dervitsiotis, McGraw-Hill International Company.
2. Operations Management: R.S. Russell, and B.W. Taylor, Pearson Education
3. Industrial Engineering and Production Management: M. Telsang, S. Chand & Company Ltd.
4. Total Quality Management, Besterfield DH, Pearson education, 1999
5. Fundamentals of Quality control and improvement, Mitra, A, John Willey & Sons, 2008

MS -352-MJ Quality Management

Marks : 50 **Credits: 2** **Contact Hrs. : 30**

Syllabus:

1. **Designing for Quality:** **5 Hours**
   Introduction to Concurrent Engineering, Quality Function Deployment (QFD) and Failure Mode and Effect Analysis (FMEA) – Concept, Methodology and Application (with case studies), Quality Circles, TPM, Traditional Quality Tools and Management tools.

2. **Introduction to Design of Experiments:** **5 hours**
   Introduction, Methods, Taguchi approach, Achieving robust design, Steps in experimental design.

3. **Contemporary Trends in Quality Engineering & Management:** **5 hours**
   Just in time (JIT) Concept, Lean Manufacturing, Agile Manufacturing, World Class Manufacturing, Total Productive Maintenance (TPM), Bench Marking, Business Process Re-engineering (BPR), Six Sigma - Basic Concept, Principle, Methodology, Implementation, Scope, Advantages and Limitation of all as applicable.
   Quality in Service Sectors:
   Characteristics of service sectors, quality dimensions in service sectors, measuring quality in different service sectors. ISO/TS 16949 Quality management systems audit, Certification & training services

4. **Quality Engineering and Management Tools, Techniques & Standards: 15 hours**
   7 QC tools, 7 New Quality Management Tools, Quality Function Deployment, 5S Technique, Kaizen, Poka-Yoke, Kanban, JIT, Quality Circle, Cost of Quality Technique, Benchmarking, Information Technology, Environmental Management Systems, Introduction to Quality Management Standards (QMS) - ISO: 9000, ISO: 14000, QS: 9000, TS 16949 (Concept, Scope, Implementation Requirements & Barriers, and Benefits), Quality Audit, FMECA, Zero defect, TPM. Six Sigma: DMAIC - Concept and Applications.
   Monitoring the process and product quality
   Product portfolio of organization, Manufacturing processes of organization, material classification criteria followed by organization, policies and procedures for storage and preservation of materials, policies, compliances and systems followed for HSE, TS-16949/any other QMS system guidelines, New Process/Product development protocol and methodology, third party agencies for calibration of equipments
   Manufacturing process being followed for each product, inspection checkpoints for product and process audits, tests performed for product and process parameters maintenance, process validation methodology followed, R&R gauge study procedures, calibration certificate contents, QC tools like MSA , SPC , Pareto analysis, Fishbone diagram etc.

References Books:

1. Quality Assurance and Total Quality Management (ISO 9000, QS 9000 ISO 14000) by K C Jain and A K Chitale, Khanna Publishers
2. Quality Control & Application by B. L. Hanson & P. M. Ghare, Prentice Hall of India
3. The Asian Productivity Organization by Takashi Osada,1991
4. KAIZEN by Masaki Imami, Mc Graw Hill ,1986
5. Total Quality Management by Dale H. Besterfield, Carol Besterfield-Michna, Glen H. Besterfield and Mary Besterfield-Sacre, Pearson Educaiton
6. Quality Management by Kanishka Bedi
7. Total Quality Management – Dr. S. Kumar, Laxmi Publication Pvt. Ltd.
8. Total Quality Management by K C Arora, S K Kataria & Sons
9. Statistical Quality Control by M. Mahajan, Dhanpat Rai & Co. (P) Ltd.
10. The essence of total quality management by John Bank, PHI 2000
11. Beyond Total Quality Management by Greg Bounds, Lyle Yorks et al, Mc Graw Hill 1994

MS -353-MJ Advanced Manufacturing Technologies

Marks: 50 **Credits: 2** **Contact Hrs : 30**

Chapter - 1: Non-Traditional Machining **6 Hrs.**

Introduction, Need and importance of Non-Traditional Machining, Classification of Non-Traditional Machining, Working Principles of various Non-Traditional Machining processes like – Electro-Chemical Machining, Abrasive Jet Machining, Electro-Discharge Machining, Wire Cut Discharge Machining, Laser Beam Machining

Chapter - 2: CNC Machines **8 Hrs.**

Introduction, Classification of CNC Machines, Axis Standards, Construction Features of CNC Machines**,** Working of CNC Machines, Advantages and Disadvantages of CNC Machines, CNC Machines control systems, Àbsolute and Incremental Coordinate system, point to point, continuous and contouring systems

CNC Part Programming

Introduction to CNC Part Programming, G-codes, M-codes, Programming formats, sequence numbers, codes to specify dimensions, codes to specify speeds and feeds, codes to specify tool function, Miscellaneous functions, Part Programming for CNC turning & Machining

Tooling for CNC Machines

Introduction, Types of cutting tools and indexable inserts, tool presetting procedures, types of tool magazines, Automatic Tool Changer, standard work holding devises, safety precautions

Chapter - 3: Surface Finishing **6 Hrs.**

Introduction, need of Surface Finishing, methods of Surface Finishing, Principles of Lapping, Honing, Super Finishing, Polishing, Buffing and Burnishing

Chapter - 4: Inspection and Quality Control in Manufacturing **10Hrs.**

Fundamental Concept of Quality, Role of Inspection and Measurement for Quality Control, Inspection types & Principles, Destructive Inspection, Testing of Composite Materials, Non-destructive Inspection: Visual Inspection, Dye Penetrant Inspection, Magnetic Particle

Inspection, Eddy Current Inspection, Ultrasonic Testing, Acoustic Emission Inspection, Radiography, Leak Testing, Advanced NDT‟s, NDT Standards, Safety in NDT

References:

1. Fundamentals of Modern Manufacturing: Materials, Processes & Systems by M P. Groover
2. Manufacturing Engineering and Technology, by Kalpakjian
3. Manufacturing Science by Amitabha Ghosh and Mallick
4. R. K. Rajput, Manufacturing Technology, Laxmi Publications.
5. P. N. Rao, Manufacturing Technology Vol. I & II, Tata McGraw Hill (2009).

MS -391-MN Industrial Safety

Marks : 50 Credits: 2 Contact Hrs. : 30

Chapter - 1: 5S activities 7 Hrs.

Basic knowledge of 5S procedures, types 5s practices, 5S checklists, skills to identify useful & non useful items, knowledge of labels, signs & colors used as indicators, knowledge on how to sort and store various types of tools, equipment, material etc., various types of waste products, impact of waste/ dirt/ dust/unwanted substances on the process/ environment/ machinery/ human body, best and environment protective ways of cleaning & waste disposal, Importance of standardization in processes, Sustainability in 5S, various materials and storage norms, understand visual controls, symbols, graphs etc.

Chapter - 2: Workplace Safety 9 Hrs.

The 6th S: Safety, Tips for getting Safe, Introduction to Workplace Safety, Regulations and Enforcement, hierarchy of hazards, improvement of workplace safety, Personal Protection Equipment for Workplace Safety, Workplace Safety Training, Visual Communication Advantages, different types of workplace safety.

Chapter - 3: Electrical Safety 7 Hrs.

Introduction, Types of Electrical Hazards, common hazards when working with electricity**,** electrical safety standards, colour standards for electrical wires, Electrical Shocks, Electrical fires, Personal Protection Equipment, Safety Training, Visual Communication Advantages, Importance of Electrical Safety, electrical safety measures, electrical safety tips, Basics of electrical safety.

Chapter - 4: Fire Safety 7 Hrs.

Introduction, Types of Fire Hazards, Fire safety standards, Personal Protection Equipment, Safety Training, Visual Communication Advantages, Importance of Fire Safety, Fire safety measures, Fire safety tips, Basics of Fire safety, Fire Prevention and Protection, Industrial Fire Protection Systems

References:

1. Probabilistic Risk Assessment for Engineering and Scientists, Komamoto and Henley, IEEE Press, 1995.
2. Industrial Accident Prevention, Heinrich et al., McGraw Hill, 1980.
3. Techniques for safety management - A systems approach, Petersen D, ASSE 1998.
4. Hand Book of Fire Technology, R.S.Gupta., Orient Blackswan, 2010
5. Electrical safety Handbook, John Cadick, Third Edition, Mc Graw Hill, 2006
6. Electrical Safety Engineering, W. Fordham Cooper, Butterworth and Heinemann Ltd London, Third edition, 1998.
7. Guidelines for Hazard Evaluation Procedures, Centre for Chemical Process safety, AICHE 2008.

MS -354-MJP Automation Practical's

Marks : 50 **Credits : 2** **Contact Hrs.: 30**

Robotics & PLC

List of Practical's:

1. Aristo Robot safety precautions.
2. Aristo Robot mechanical interface.
3. Aristo Robot troubleshoot & Maintenance.
4. Aristo Robot Assembly picks and place operation.
5. Aristo Robot chuck open and close operation.
6. Aristo Robot vice loading and unloading operation.
7. Aristo Robot bearing shaft assembly operation.
8. Other practical relevant to Syllabus (as per requirement)

Programmable Logic Controller Programming

Experiments covering following aspects

Basic constituents and working of PLC

Hardware specification, front indications, terminals and ports.

Installation, powering and wiring of system including information on addressing.

Information on Programming Unit and converting PC / Laptop into a Programming Unit including

Information on communication hardware. Programming language and option of program Representation in LAD, STL and FBD

i. Instructions / programming for

a. Combinational Logic Control
b. Set and Reset
c. Information on Elementary Data Types
d. Comparison
e. Timer
f. Basic Math
g. Conversion

MS -355-MJP Work shop Practices II Practical

Marks : 50 Credits : 2 Contact Hrs. : 30

Chapter 3 = How to Use Hand Tools, Power Tools & How to do Fitting

1 Uses of Fitting hand tools bench vice, hammers, chisels, files, hacksaw, surface plate, punch block, angle plate, try square, marking block , steel rule, twist drills, reamers, tap set, die Set and uses of PPE 2. How to operate fitting shops machineries. 3. Uses of Different types of Drilling machine, Power saw, grinder their uses , how to maintain safety when using above machineries .

Chapter 4 = Application of Cutting Tools

1. Uses of different types Cutting tools, precaution to be taken when using cutting tools, application of PPE . 2. How to do counter boring operation, steps of counter boring operation. 3. How to do reaming operation, steps of reaming operation & their precaution. 4. Uses of Differenttypes of taps & tapping operation. 5. Die passing operation.

Chapter 5 = Maintenance of work shop.

1. Application of 5S at work shop. 2. Operate the machine using the recommended Personal protective Element (PPE). 3. Maintain a clean and safe working environment near the work place and ensure there is no spillage of chemicals, production waste, oils, solvent etc. 4. Ensure that the waste disposal is done in designated area and manner as per organization SOP.

Reference Book

1. Workshop Practice, McGraw Hill Education,
2. A Textbook of Manufacturing Process(Workshop Tech.),S. .Chand and Co. New Delhi
3. Workshop Technology (Part I,II& III) - Chapma

MS -360-MN Workplace Management & 5S Activities

Marks : 50 **Credits : 2** **Contact Hrs. : 30**

Chapter - 1: Leadership **10 Hrs.**

Management Education-History, Development, Importance, Areas of specialization, Meaning and Types of Leaders, Qualities of leader, Examples, Leadership- Definition, importance, leadership in various organizations, Leadership styles-task-people matrix, Persuasive, Authoritative, Democratic, Delegative, Leadership styles. Maturity of followers, situational leadership

Motivation: Meaning, Importance of Motivation, Types of Motivation- Intrinsic, Extrinsic, Examples,

Maslow's motivation theory- pyramid of needs, individual and industrial applications, Tips for Motivation

Team Building: Team- Need, Definition, Difference between group and team, Characteristics of a good team

Steps in team formation- forming, norming, storming, performing, adjourning, Roles of team members, Characteristics of a good team member, Types of teams-Work, mgmt, cross functional, quality circle, self-managed team

Chapter - 2: Professional Skills **7 Hrs.**

Decision Making: Importance of decision making, Characteristics of good decision, Types of decisions- programmed, non programmed, strategic, tactical, impulsive, Group decision making, Steps of decision making, Make decisions on a suitable course of action or response keeping in view resource utilization while meeting commitments

Plan and Organize: Plan and Organize work to achieve targets and deadlines,

Customer Centricity**:** Check that the work meets customer requirements, Deliver consistent and reliable service to customers

Problem Solving: Apply problem solving approaches in different situations

Critical Thinking: Apply balanced judgments to different situations

Chapter - 3: Conflict Resolution **5 Hrs.**

Definition, types, indicators of conflicts, Sources of conflict - ego, poorly defined authority and responsibility, power, interests, greed, difference in value system, complex work situations, Skills for conflict resolution, Steps in conflict management -Mapping of conflict, negotiation- steps in negotiation, Styles of conflict management- collaborating, competing, cooperating, avoiding, compromising

Chapter - 4: 5S activities **5 Hrs.**

Basic knowledge of 5S procedures, types 5s practices, 5S checklists, skills to identify useful & non useful items, knowledge of labels, signs & colors used as indicators, knowledge on how to sort and store various types of tools, equipment, material etc., various types of waste products, impact of waste/ dirt/ dust/unwanted substances on the process/ environment/ machinery/ human body, best and environment protective ways of cleaning & waste disposal, Importance of standardization in processes, Sustainability in 5S, various materials and storage norms, understand visual controls, symbols, graphs etc.

References:

1. Principles of management and organizational behavior, Dr. Kumkum Mukherjee, Tata McGraw Hill Education Pvt Ltd

2. Personality Development and soft skills, Barun K Mitra, Oxford University Press

3. Quality, Safety, and Environment: Synergy in the 21st Century, Pascal Dennis, ASQ publication**.**
4. Systematic Safety Training, Kingsley Hendrick, Marcel Dekker publication, 1990.
5. Decision support systems and intelligent systems, Efraim Turban and Jay E Aronson, Pearsons Education Asia.
6. Decision Support systems, Sprague R. H. Jr. and H. J. Watson, Prentice Hall, 4th Edition, 1996
7. The Asian Productivity Organization by Takashi Osada,1991
8. KAIZEN by Masaki Imami, Mc Graw Hill ,1986
9. Total Quality Management – Dr. S. Kumar, Laxmi Publication Pvt. Ltd.
10. Statistical Quality Control by M. Mahajan, Dhanpat Rai & Co. (P) Ltd.
11. The essence of total quality management by John Bank, PHI 2000
12. Beyond Total Quality Management by Greg Bounds, Lyle Yorks et al, Mc Graw Hill 1994

MS -361-MNP Workplace Management & 5S Activities Lab

[2 Credits]

Objective: To understand and implement workplace organization techniques (5S methodology) for improved efficiency, safety, and productivity in industrial environments.

List of Assignments/Practical Activities

1. Introduction to 5S & Workplace Management

1. **Theory & Principles of 5S**
   - Study of the five pillars: **Sort (Seiri), Set in Order (Seiton), Shine (Seiso), Standardize (Seiketsu), Sustain (Shitsuke)**
   - Case studies on 5S implementation in industries.
2. **Workplace Audit (Before 5S)**
   - Conduct a workplace inspection (lab/workshop) to identify clutter, inefficiencies, and safety hazards.
   - Document findings with photos/videos.

2. Hands-On 5S Implementation

3. **Sort (Seiri) – Remove Unnecessary Items**
   - Identify and segregate necessary vs. unnecessary tools/materials.
   - Use red-tagging for unwanted items.
4. **Set in Order (Seiton) – Organize Efficiently**
   - Design an optimized layout for tools, equipment, and materials.
   - Implement shadow boards, labeling, and visual management techniques.
5. **Shine (Seiso) – Clean & Inspect**
   - Perform deep cleaning of the workspace.
   - Identify maintenance issues (leaks, damages) and report them.

6. **Standardize (Seiketsu) – Create Procedures**
   - Develop standard operating procedures (SOPs) for workplace organization.
   - Implement checklists for daily 5S activities.
7. **Sustain (Shitsuke) – Maintain Discipline**
   - Conduct mock audits to ensure compliance.
   - Implement a 5S sustainment plan (e.g., weekly reviews).

3. Performance Evaluation & Reporting

8. **Workplace Audit (After 5S)**
   - Compare before-and-after conditions.
   - Measure improvements in efficiency, safety, and space utilization.
9. **Group Presentation & Report Submission**
   - Present findings with visual evidence (photos, videos, metrics).
   - Submit a detailed lab report on the 5S implementation process.

Assessment Criteria

- ✔ Participation in hands-on 5S activities
- ✔ Quality of workplace audits (before & after)
- ✔ Effectiveness of visual management implementation
- ✔ Clarity and completeness of the final report

MS -392-MNP Industrial Safety – Practicals

Module 1: Introduction to Industrial Safety

- **Experiment** : Demonstration of Personal Protective Equipment (PPE) – types, uses, and correct wear procedure
- **Experiment** : Identification of workplace hazards using standard checklists
- **Tools**: Safety gear kits, hazard identification cards

Module 2: Fire Safety and Emergency Response

- **Experiment** : Demonstration of different types of fire extinguishers and their applications
- **Experiment**: Fire drill and emergency evacuation procedures
- **Experiment** : Simulation of fire scenarios and response planning
- **Tools**: Fire extinguishers, fire alarm systems, evacuation maps

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Module 3: Workplace Safety Procedures

- **Experiment** : Conducting a Job Safety Analysis (JSA) for a given industrial task
- **Experiment** : Preparing a checklist for housekeeping and general safety in an industrial shop floor
- **Experiment** : Safety signage identification and implementation in a layout plan
- **Tools**: JSA templates, housekeeping audit sheets, signboard samples

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Module 4: Safety Audit and Training

- **Experiment** : Conducting a mock safety audit in a simulated workplace
- **Experiment** : Designing a safety training module and delivering a short safety briefing
- **Tools**: Audit checklist, presentation materials

MS -381,382-OJT On-Job Training

Marks : 50 **Credits: 2**

Objective:

To enhance student employability and entrepreneurial potential by providing real-world industrial exposure through **On-Job Training (OJT)** in leading manufacturing industries.

Overview:

The **B.Voc. in Manufacturing Technology** program includes **compulsory On-Job Training (OJT)** as an essential part of the curriculum. This initiative aims to bridge the gap between classroom knowledge and industry practices by immersing students in actual manufacturing environments.

Key Features of OJT:

- Conducted in **leading manufacturing industries** across various domains.
- Scheduled as part of the **Second Semester curriculum**.
- Aims to provide **hands-on skills, industrial work culture experience**, and **real-time problem-solving exposure**.
- Helps students build **industry connections**, identify **career interests**, and develop **job-ready competencies**.

Student Responsibilities:

1. Participation:

- Students must actively engage in OJT, follow company policies, and demonstrate professionalism throughout the training period.

2. Report Submission:

- At the end of the Second Semester, students are required to submit an **OJT Report** which must include:
  - **Industry Details** (Name, Location, Type)
  - **Training Duration and Department**
  - **Work Assigned and Skills Learned**
  - **Technical Activities and Tools Used**
  - **Project or Task Contributions**
  - **Key Learning Outcomes and Achievements**
  - **Suggestions or Reflections**
- The report must be **duly certified** by the **competent authority from the industry** (Supervisor/Manager).

3. Presentation:

- Students must deliver a **presentation** based on their report, highlighting:
  - Major tasks undertaken
  - Skills acquired
  - Challenges faced and how they were handled
  - Learning impact on their career path
- The presentation will be evaluated by faculty members or a designated academic panel.

Evaluation Parameters:

Criteria	Marks
Participation and Industrial Behavior	10
Quality and Content of Report	20
Presentation and Communication	10
Learning and Skill Development	10
Total	**50**

Important Notes:

- OJT is **mandatory** for successful completion of the semester.
- Students must maintain a **logbook or diary** during training to record daily activities.
- Any misconduct or lack of attendance may lead to disqualification or re-training.