STUDY & EVALUATION SCHEME WITH SYLLABUS

FOR

B. TECH 4\textsuperscript{th} YEAR
PRODUCTION ENGINEERING/INDUSTRIAL PRODUCTION ENGINEERING

ON

CHOICE BASED CREDIT SYSTEM

(EFFECTIVE FROM THE SESSION: 2019-20)
### SEVENTH SEMESTER

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<th>Sl.No.</th>
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<th>Subject Name</th>
<th>Department</th>
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<th>Th/Lab Marks</th>
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<td>RME070</td>
<td>Composite Materials</td>
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<td>RPI070</td>
<td>Advanced Material Technology</td>
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<td>RPI071</td>
<td>Quality Engg. in Manufacturing</td>
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<td>RME073</td>
<td>Additive Manufacturing</td>
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<td>RPI075</td>
<td>Reverse Engineering</td>
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<td>RPI076</td>
<td>Decision Support &amp; Intelligent System</td>
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<tr>
<td>RPI077</td>
<td>Process Planning &amp; Cost Estimation</td>
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- Students who was not-place in any company, it is mandatory to select any one subject from DE-5 & 6.
- Students who was place in any company, it is mandatory to select MOOC subject in both DE-5 & 6.

### EIGHT SEMESTER

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<th>Sl.No.</th>
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<td>RPI081</td>
<td>Lean Manufacturing</td>
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<td>RPI082</td>
<td>Project Management</td>
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<td>RPI083</td>
<td>Supply Chain Management</td>
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<tr>
<td>RME085</td>
<td>Total Quality Management</td>
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<tr>
<td>RPI085</td>
<td>Flexible Manufacturing System</td>
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<tr>
<td>RPI086</td>
<td>Reliability Engineering</td>
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<tr>
<td>RPI087</td>
<td>Innovation &amp; Entrepreneurship</td>
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**OR**

#### MOOC Subject Name

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<td>RME084</td>
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**OR**

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<td>RPI088</td>
<td>Principles of Metal Forming Technology.</td>
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SEMESTER-VII
UNIT- I
Automation:
Definition, Advantages, goals, types, need, laws and principles of Automation. Elements of Automation.
Fluid power and its elements, application of fluid power, Pneumatics vs. Hydraulics, benefit and limitations of pneumatics and hydraulics systems, Role of Robotics in Industrial Automation.

UNIT- II
Manufacturing Automation:
Classification and type of automatic transfer machines; Automation in part handling and feeding, Analysis of automated flow lines, design of single model, multi model and mixed model production lines.
Programmable Manufacturing Automation CNC machine tools, Machining centres, Programmable robots, Robot time estimation in manufacturing operations.

UNIT- III
Robotics:
Robot anatomy, configuration of robots, joint notation schemes, work volume, manipulator kinematics, position representation, forward and reverse transformations, homogeneous transformations in robot kinematics, D-H notations, kinematics equations, introduction to robot arm dynamics.

UNIT -IV
Robot Drives and Power Transmission Systems:
Mechanical transmission method: Gear transmission, Belt drives, Rollers, chains, Links, Linear to Rotary motion conversion, Rotary-to-Linear motion conversion, Rack and Pinion drives, Lead screws, Ball Bearings.
Robot end Effectors:
Classification of End effectors – active and passive grippers, Tools as end effectors, Drive system for grippers. Mechanical, vacuum and magnetic grippers. Gripper force analysis and gripper design.

UNIT- V
Robot Simulation:
Methods of robot programming, Simulation concept, Off-line programming, advantages of offline programming.
Robot Applications:
Robot applications in manufacturing-Material transfer and machine loading/unloading, Processing operations like Welding & painting, Assembly operations, Inspection automation.
Limitation of usage of robots in processing operation. Robot cell design and control, Robot cell layouts-Multiple robots & Machine interference.

Books and References:
3. Robotic: Control, Sensing, Vision and Intelligence, by Fu, McGraw Hill.
4. Introduction to Industrial Robotics, by Nagrajan, Pearson India.
5. Robotics, by J.J. Craig, Addison-Wesley.
UNIT-I:
**Principles of Computer Graphics:**
Point plotting, drawing of lines, Bresenham’s circle algorithm.

**Transformation in Graphics:**
Co-ordinate system used in Graphics and windowing, view port, views.
2D transformations – rotation, scaling, translation, mirror, reflection, shear - homogeneous transformations – concatenation.
3D Transformation – Perspective Projection – Technique (Description of techniques only).

**Geometric Modelling:**
Design of curved shapes- Cubic spline – Bezier curve – B-spline – Design of Surfaces - features of Surface Modelling Package – Solid Primitives, CSG.
B-rep and description of other modelling techniques like Pure primitive instancing, cell decomposition, spatial occupancy enumeration, Boolean Operations (join, cut, intersection), Creating 3D objects from 2D profiles (extrusion, revolving etc).

UNIT-II:
**Graphics standard & Data storage:**
Standards for computer graphics GKS, PHIGS. Data exchangestandards – IGES, STEP - Manipulation of the model - Model storage.

**Finite Element Modelling:**
Introduction, Mesh Generation – mesh requirements.
FullyAutomatic Methods- Element-based approach, Application, Mesh Refinements using Isoperimetric Finite Elements, Meshing in high gradient areas, Transition Regions. Sub modelling Concept.
An overview of modelling software’s like PRO-E, CATIA, IDEAS, SOLID EDGE etc.

UNIT-III:
**CAM:**
Scope and applications – NC in CAM – Principal types of CNC machine tools and there construction features – tooling for CNC – ISO designation for tooling – CNC operating system – FANUC, SINUMERIK – LINUMERIK.
Programming for CNC machining – coordinate systems – manual part programming – computer assisted part programming – CNC part programming with CAD system.

**Material handling in CAM environment:**
Types – AGVS – AS/RS – Swarf handling and disposal of wastes – single and mixed mode assembly lines – quantitative analysis of assembly systems.

UNIT-IV:
**Robotics:**

**Quality Function Deployment:**

UNIT-V:
**Rapid prototyping:**
Need for rapid prototyping, Basic principles and advantages of RP, General features and classifications of different RP techniques with examples.
Introduction to three representative RP techniques: Fusion Deposition Modelling, Laminated Object Manufacturing and Stereo-lithography.

**Flexible manufacturing cells:**

**Books and References:**
List of Experiments: (Total EIGHT Experiments are to carried out. FOUR Experiments each from CAD and CAM.)

A. CAD Experiments:
1. Line Drawing or Circle Drawing experiment: Writing and validation of computer program.
3. Design of machine component or other system experiment: Writing and validation of computer program.
4. Understanding and use of any 3-D Modelling Software commands.
6. Writing a small program for FEM for 2 spring system and validation of program or using a FEM Package.
7. Root findings or curve fitting experiment: Writing and validation of computer program.
8. Numerical differentiation or numerical integration experiment: Writing and validation of computer program.

B. CAM Experiments:
1. To study the characteristic features of CNC machine.
2. Part Programming (in word address format) experiment for turning operation (including operations such as grooving and threading) and running on CNC machine.
3. Part Programming (in word address format or ATP) experiment for drilling operation (point to point) and running on CNC machine.
4. Part Programming (in word address format or ATP) experiment for milling operation (contouring) and running on CNC machine.
5. Experiment on Robot and programs.
6. Experiment on Transfer line/Material handling.
7. Experiment on difference between ordinary and NC machine, study or retrofitting.
8. Experiment on study of system devices such as motors and feedback devices.
9. Experiment on Mechatronics and controls.
List of Experiments: The practical can include the following topics:

UNIT-I:
**Artificial Muscles:**
After a general overview of artificial muscle technologies used in robotics, the students fabricate dielectric elastomer actuators (DEAs) by hand and test the mechanical and electrical properties of their devices, comparing their results with theoretical predictions.

UNIT-II:
**Outdoor Flying Robots:**
This is a practical exercise on the design of a combined altitude and speed controller for a miniature autonomous airplane.

**Mobile robot position estimation and navigation:**
The goal of this practical is to implement position estimation and navigation on a real mobile robot.

UNIT-III:
**Teaching Robots to Accomplish a Manipulation Task:**
In this robotic practical, the student will be teaching a robot to build a tower by stacking several objects on top of each other.

**Industrial Robot Control:**
The goal is to control a robot specifically designed for tasks such as assembly, manipulation or packaging where there is need of fast and precise actions.

UNIT-IV:
**Haptics:**
After a brief overview of the state of the art of haptic devices, the students need to generate useful sensations in respect to a given problem, study the type of sensations that can be produced, as well as how they can be programmed.

**Assembly, programming and characterization of a modular fish robot:**
This practical is aimed at realizing a swimming fish robot using the same modules used for the Salamandra robotica II and AmphiBot III robots.
DEPARTMENTAL ELECTIVE-III

COMPOSITE MATERIALS

UNIT-I
Overview of Composite material:
Classifications of Engineering Materials, Concept of composite materials.
Matrix materials, Functions of a Matrix, Desired Properties of a Matrix, Polymer Matrix (Thermosets and Thermoplastics), Metal matrix, Ceramic matrix, Carbon Matrix, Glass Matrix etc.

UNIT-II
Types of Reinforcements/Fibers:
Role and Selection of reinforcement materials.
Types of fibres: Glass fibers, Carbon fibers, Aramide fibers, Metal fibers, Alumina fibers, Boron Fibers, Silicon carbide fibers, Quartz and Silica fibers, Multiphase fibers, Whiskers, Flakes etc.
Mechanical properties of fibres:
Material properties that can be improved by forming a composite material and its engineering potential.

UNIT-III
Various types of composites:
Classification based on Matrix Material: Organic Matrix composites, Polymer matrix composites (PMC), Carbon matrix Composites or Carbon-Carbon Composites, Metal matrix composites (MMC), Ceramic matrix composites (CMC).
Classification based on reinforcements: Fiber Reinforced Composites, Fiber Reinforced Polymer (FRP) Composites, Laminar Composites, Particulate Composites.

UNIT-IV
Fabrication methods:
Processing of Composite Materials: Overall considerations, Autoclave curing, Other Manufacturing Processes like filament welding, compression moulding, resin transplant method, pultrusion, pre-peg layer, Fiber-only performs, Combined Fiber-Matrix performs.

UNIT-V
Testing of Composites and Analysis:
Mechanical testing of composites, tensile testing, Compressive testing, Intra-laminar shear testing, Inter-laminar shear testing, Fracture testing etc.
Analysis of laminated plates: equilibrium equations of motion, energy formulation, static bending analysis, buckling analysis, free vibrations, natural frequencies.

Books and References:
UNIT-I:
Overview:

UNIT-II
Electro-Rheological & piezoelectric materials:
Basics, Principles and instrumentation and application of Magnetorheological fluids – Piezoelectric materials: polymers and ceramics, mechanism, properties and application. Introduction to electro-restrictive and magneto-restrictive materials.

UNIT-III:
Shape memory materials:
Classification of SMA alloys- mechanism of magnetic SMA – applications of SMA – continuum applications of SMA fasteners – SMA fibers – reaction vessels, nuclear reactors, chemical plant, etc. – micro robot actuated by SMA.
SMA memorization process (Satellite Antenna Applications) SMA blood clot filter – Impediments to applications of SMA – Shape memory polymers– mechanism of shape memory-Primary moulding – secondary moulding– types and applications.

UNIT-IV:
Orthopaedic and dental materials:

UNIT-V:
Applications of materials:
The lungs – vascular implants: vascular graft, cardiac valve prostheses, card– Biomaterials in
ophthalmology – skin grafts – connective tissue grafts – tissue adhesives – drug delivery methods and materials.

Books and References:
UNIT-I:
Overview:
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).

UNIT-II:
Quality Engineering and Management Tools, Techniques & Standards:
7 QC tools, 7 New Quality Management Tools, 5S Technique, Kaizen, Poka-Yoke, Quality Circle, Cost of Quality Technique.

UNIT-III:
Total Quality Management:
Basic Philosophy, Approach, Implementation Requirements & Barriers.
Designing for Quality:
Introduction to Concurrent Engineering, Quality Function Deployment (QFD) and Failure Mode and Effect Analysis (FMEA) – Concept, Methodology and Application (with case studies).

UNIT-IV:
Introduction to Design of Experiments:
Introduction, Methods, Taguchi approach, Achieving robust design, Steps in experimental design.

UNIT-V:
Contemporary Trends in Quality Engineering & Management:
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.

Books and References:
2. Quality Control & Application by B. L. Hanson & P. M. Ghare, Prentice Hall of India.
5. Total Quality Management – Dr. S. Kumar, Laxmi Publication Pvt. Ltd.
7. Statistical Quality Control by M. Mahajan, Dhanpat Rai & Co. (P) Ltd.
UNIT-I  
**Overview of AM:**  
History and Advantages of Additive Manufacturing, Distinction Between Additive Manufacturing and CNC Machining, Types of Additive Manufacturing Technologies, Nomenclature of AM Machines.  
**Direct and Indirect Processes:**  
Prototyping, Manufacturing and Tooling.  
**Layer Manufacturing Processes:**  
Polymerization, Sintering and Melting, Extrusion, Powder-Binder Bonding, Layer Laminate Manufacturing, Other Processes; Aerosol printing and Bio plotter.

UNIT-II  
**Development of Additive Manufacturing Technology:**  
Computer Aided Design Technology, Other Associated Technology, Metal and Hybrid Systems. Generalized Additive Manufacturing Process Chain; The Eight Steps in Additive Manufacturing, Variation from one AM Machine to Another, Metal System, Maintenance of Equipment, Material Handling Issue, Design of AM.

UNIT-III  
**Additive Manufacturing Processes:**  
Vat Photopolymerization, Materials, Reaction Rates, Photopolymerization Process Modelling, Scan Patterns.  
**Powder Bed Fusion Processes:**  
**Material Jetting:**  
**Directed Energy Deposition Processes:**  
**Direct Write Technologies:**  
Ink-Based DW, laser Transfer DW, Thermal Spray DW, Beam Deposition DW, Liquid Phase Direct Deposition, Hybrid Technologies.

UNIT-IV  
**Design & Software Issues:**  
Additive Manufacturing Design and Strategies; Potentials and Resulting Perspectives, AM based New Strategies, Material Design and Quality Aspects for Additive Manufacturing; Material for AM, Engineering Design Rules for AM.  
**Software Issue for Additive Manufacturing:**  
Introduction, Preparation of CAD Models: The STL file, Problem with STL file, STL file Manipulation, Beyond the STL file, Additional Software to Assist AM.

UNIT-V  
**Material Design & Quality Aspects:**  
**Applications:**  
Aerospace, Automotive, Manufacturing, Architectural Engineering, Art, Jewellery, Toys, Medical, Biomedical, Dental, Bio-printing, Tissue & Organ Engineering and many others.
Books and References:
UNIT-I
Overview of OR:
Linear Programming:
Introduction & Scope, Problem formulation, Graphical Method, Simplex methods, primal and dual problem sensitivity analysis.

UNIT-II
Transportation Problem:
Methods of obtaining initial and optimum solution, degeneracy in transportation problems, unbalanced Transportation Problem.
Assignment Problem:
Methods of obtaining optimum solution, Maximization problem, travelling salesman problem.

UNIT-III
Game Theory:
Two-person Zero sum game, Solution with/without saddle point, dominance rule, Different methods like Algebraic, Graphical and game problem as a special case of Linear Programming.
Sequencing:
Basic assumptions, n Jobs through 2-3 machines, 2 Jobs on m machines.

UNIT-IV
Stochastic inventory models:
Single & multi period models with continuous & discrete demands, Service level & reorder policy.
Simulation:
Use, advantages & limitations, Monte-Carlo simulation, Application to queuing, inventory & other problems.

UNIT-V
Queuing models:
Characteristics of Queuing Model, M/M/1 and M/M/S system, cost consideration.
Project management:
Basic Concept of network Scheduling, Rules for drawing network diagram, Applications of CPM and PERT techniques in Project planning and control; crashing of operations; resource allocation.

Books and References:
UNIT-I: Introduction to New Product Development.
Tasks of detailed design, new frontiers of Computer-Aided Design tools.

UNIT-II: Reverse Engineering:
Objectives and common application fields.
Existing technologies.
Contact systems.
Non-contact systems.
Manipulation of acquired data.
Practical experiences.

Design for Additive Manufacturing.

UNIT-IV: Rapid Prototyping technologies:
For polymers with a particular focus on Stereolithography (SLA) and Fused Deposition Modelling (FDM).
For metals.
For other materials.
Practical experiences.

UNIT-V: Employment of Reverse Engineering and Rapid Prototyping technologies in different industrial fields with an outlook on the South Tyrolean industrial fabric.

Books and References:
2. Hacking the Xbox: An Introduction to Reverse Engineering.
4. The Art of Memory Forensics: Detecting Malware and Threats in Windows, Linux, and Mac Memory.
7. Practical Reverse Engineering: x86, x64, ARM, Windows Kernel, Reversing Tools, and obfuscation.
UNIT-I:
Management Support Systems: An Overview:
Managers and Decision-Making; Managerial Decision-Making and Information Systems; Managers and Computer Support; Computerized Decision Support and the Supporting Technologies.

Decision-Making Systems, Modelling, and Support:
Decision-Making: The Implementation Phase; How Decisions Are Supported; Personality Types, Gender, Human Cognition, and Decision Styles; The Decision-Makers.

UNIT-II:
Decision Support Systems:
DSS Configurations; What Is a DSS? Characteristics and Capabilities of DSS; Components of DSS; The Data Management Subsystem.
The Model Management Subsystem; The User Interface (Dialog) Subsystem; The Knowledge-Based Management Subsystem; The User; DSS Hardware; DSS Classifications.

Modelling and Analysis:
Modelling; Static and Dynamic Models; Certainty, Uncertainty, and Risk; Influence Diagrams; MSS Modelling with Spreadsheets; Decision Analysis of a Few Alternatives.
The Structure of MSS Mathematical Models; Mathematical Programming Optimization; Multiple Goals, Sensitivity Analysis, What-If, and Goal Seeking.
Problem-Solving Search Methods; Heuristic Programming; Simulation; Visual Interactive Modelling and Visual Interactive Simulation; Quantitative Software Packages; Model Base Management.

Decision Support System Development:
Introduction to DSS Development; The Traditional System Development Life cycle; Alternative Development Methodologies.
Prototyping: The DSS Development Methodology; Change Management; DSS Technology Levels and Tools; DSS Development Platforms; DSS Development Tool Selection; Team-Developed DSS; End User Developed DSS; Putting the DSS together.

UNIT-III:
Knowledge Management:
Introduction to Knowledge Management; Organizational Learning and Transformation; Knowledge Management Initiatives; Approaches to Knowledge Management; Information Technology in Knowledge Management.
Knowledge Management Systems Implementation; Roles of People in Knowledge Management; Ensuring Success of Knowledge Management.

UNIT-IV:
Artificial Intelligence and Expert Systems: Knowledge-Based Systems:
Concepts and Definitions of Artificial Intelligence; Evolution of Artificial Intelligence; The Artificial Intelligence Field; Basic Concepts of Expert Systems; Applications of Expert Systems.

Knowledge Acquisition, Representation, and Reasoning:
Concepts of Knowledge Engineering; Scope and Types of Knowledge; Methods of Knowledge Acquisition from Experts; Knowledge Acquisition from Multiple Experts; Automated Knowledge Acquisition from Data and Documents.

Knowledge Verification and Validation; Representation of Knowledge; Reasoning in Rule-Based Systems; Explanation and Metaknowledge; Inferencing with Uncertainty; Expert Systems Development; Knowledge Acquisition and the Internet.

UNIT-V:

Advanced Intelligent Systems:
Machine-Learning Techniques; Case-Based Reasoning; Basic Concept of Neural Computing; Learning in Artificial Neural Networks; Developing Neural Network-Based Systems.
Genetic Algorithms Fundamentals; Developing Genetic Algorithm Applications; Fuzzy Logic Fundamentals; Developing Integrated Advanced Systems.

Intelligent Systems over the Internet:
Web-Based Intelligent Systems; Intelligent Agents: An Overview; Characteristics of Agents; Why Intelligent Agents?
Classification and Types of Agents; Internet-Based Software Agents; DSS Agents and Multi-Agents; Semantic Web: Representing Knowledge for Intelligent Agents; Web-Based Recommendation Systems; Managerial Issues of Intelligent Agents.

Books and References:
3. Business Intelligence and Analytics: Systems for Decision Support” by Ramesh Sharda and DursunDelen.
4. Decision Support and Business Intelligence Systems” by Efraim Turban and Ramesh E Sharda.
6. Decision Support, Analytics, and Business Intelligence (Information Systems Collection)” by Daniel J Power.
UNIT-I:
Overview of process planning:
Introduction- methods of process planning-Drawing Interpretation-Material evaluation – steps in process selection-. Production equipment and tooling selection.

UNIT-II:
Process planning activities:
Process parameters calculation for various production processes-Selection jigs and fixtures election of quality assurance methods - Set of documents for process planning-Economics of process planning- case studies.

UNIT-III:
Introduction to cost estimation:

UNIT-IV:
Production cost estimation:

UNIT-V:
Machining time calculation:
Estimation of Machining Time - Importance of Machine Time Calculation- Calculation of Machining Time for Different Lathe Operations, Drilling and Boring - Machining Time Calculation for Milling, Shaping and Planning -Machining Time Calculation for Grinding.

Books and References:
5. Process planning and cost estimation by M. Adithan.
SEMESTER-VIII
DEPARTMENTAL ELECTIVE-V

DESIGN OF EXPERIMENT

L-T-P
3-1-0

UNIT-I:
Strategy of Experimentation, Typical applications of Experimental design, Basic Principles, Guidelines for Designing Experiments.
Concepts of random variable, probability, density function cumulative distribution function. Sample and population, Measure of Central tendency; Mean median and mode, Measures of Variability, Concept of confidence level. Statistical Distributions: Normal, Log Normal & Weibull distributions. Hypothesis testing, Probability plots, choice of sample size. Illustration through Numerical examples.

UNIT-II:
Classical Experiments: Factorial Experiments: Terminology: factors, levels, interactions, treatment combination, randomization, Two-level experimental designs for two factors and three factors. Three-level experimental designs for two factors and three factors, Factor effects, Factor interactions, Fractional factorial design, Saturated Designs, Central composite designs. Illustration through Numerical examples.
Measures of variability, Ranking method, Column effect method & Plotting method, Analysis of variance (ANOVA) in Factorial Experiments: YATE’s algorithm for ANOVA, Regression analysis, Mathematical models from experimental data. Illustration through Numerical examples.

UNIT-III:

UNIT-IV:
Types of Orthogonal Arrays, selection of standard orthogonal arrays, Linear graphs and Interaction assignment, Dummy level Technique, Compound factor method, Modification of linear graphs. Illustration through Numerical examples.

UNIT-V:
Parameter and tolerance design concepts, Taguchi’s inner and outer arrays, parameter design strategy, tolerance design strategy. Illustration through Numerical examples.

Books and References:
UNIT-I:
Overview:
SEVEN forms of waste and their description; Historicalevolution of lean manufacturing; Global competition, Customerrequirements, Requirements of other stake holders.
Meaning of LeanManufacturing System (LMS), Meaning of Value and waste, Need for LMS, Symptoms of underperforming organizations, Meeting the customer requirement, Elements of LMS.

UNIT-II:
Primary tools used in LMS:
Meaning and Purpose of 5S Work placeorganization, 5S process – Sort, set in order, Shine, Standardize, Sustain, implementing 5S.
Meaning and purpose of TPM, Pillars of TPM, Conditions for TPM success, TPM implementation process, Overall Equipment Effectiveness and problems on computation of OEE.

UNIT-III:
Process Mapping and Value StreamMapping (VSM) – Need for process maps, advantages, types and its construction, steps in preparing VSM.
Concept of work Cell and its design, Line balancing algorithms and problems.

UNIT-IV:
Secondary tools used in LMS:
Cause and effect diagram, Pareto chart, Radar chart, Poke Yoke, Kanban, Automation, SMED, Standardized fixture, DFMA, JIT.
Visual workplace, problems on Pareto analysis and computation of number of kanbans.

UNIT-V:
LMS Rules:
Stability, Management, Standardized work, Pull system, Continuous improvement. Lean Implementation: Training, selecting the projects, preparing project charter, project implementation, Project review.
Implementing LMS for higher productivity: Operator, process, machinery and equipment, workplace organization, Inventory, LMS Design Process.

Books and References:
UNIT-I:
Project Management Concepts:
Introduction, project characteristics, taxonomy of projects, project identification and formulation. Establishing the project and goals.
Nature & context of project management; phases of PM, A framework for PM issues, PM as a conversion process, project environment & complexity.
Organizing human resources, organizing systems & procedures for implementation. Project direction.

UNIT-II:
Project Organization & Project Contracts:
Introduction, functional organization, project organization, matrix organization, modified matrix organization.
Pure project organization, selection of project organization structure, project breakdown structures, project contracts, types of contracts, types of payments to contractors.

UNIT-III:
Project Appraisal & Cost Estimation:
Introduction, technical appraisal, commercial appraisal, economic appraisal, financial appraisal, management appraisal, social cost/benefit analysis, project risk analysis.
Cost analysis of the project, components of capital cost of a project, modern approach to project performance analysis.

UNIT-IV:
Project Planning & Scheduling:
Introduction to PERT & CPM, planning and scheduling networks, time estimation, determination of critical path, CPM model, event slacks & floats, PERT model.
Expected time for activities, expected length of critical path, calculating the project length and variance, PERT & CPM cost accounting systems, lowest cost schedule, crashing of networks, linear programming formulation of event-oriented networks, updating of networks, LOB technique.

UNIT-V:
Modification & Extensions of Network Models:
Complexity of project scheduling with limited resources, resource levelling of project schedules, resource allocation in project scheduling - heuristic solution.
Precedence networking- examples with algorithm, decision networks, probabilistic networks, computer aided project management essential requirements of PM software, software packages for CPM. Enterprise- wide PM, using spread sheets for financial projections.

Books and References:
1. Project Management by Harvey Maylor, Pearson India.
5. Project Management: A Life Cycle Approach by Kanda, PHI, India.
SUPPLY CHAIN MANAGEMENT

UNIT-I:
Introduction to Supply Chain Management, Understanding the Supply Chain.
Supply Chain Performance: Competitive and Supply Chain Strategies, achieving Strategic Fit and Scope of Strategic Fit.

UNIT-II:
Supply Chain Drivers and Metrics: Drivers of Supply Chain Performance, Framework for structuring Drivers, Facilities, Inventory, Transportation, Information, Sourcing and Pricing, Case Study: Seven-Eleven Japan Company.

UNIT-III:
Planning Demand and Supply in a Supply Chain: Demand Forecasting in a Supply Chain, Aggregate Planning in a Supply Chain.
Designing Distribution Networks and Application to E-Business- Role of distribution, factors influencing distribution network design, design options for a distribution network, E-Business and the distribution network.

UNIT-IV:
Network Design in the Supply Chain- Role of network design in the supply chain, factors influencing network design decisions, framework for network design decisions.
Role of Information Technology in supply chain, coordination in a supply chain, Bullwhip Effect, Effect on performance due to lack of coordination, obstacles to coordination in a supply chain.

UNIT-V:
Factors influencing logistics and decisions.
Benchmarking and performance measurement.

Books and References:
3. Supply Chain Management – Maretin Christopher.
4. World Class Supply Management: The key to Supply Chain Management- Burt, Dobler and Straling – TMH Publication.
DEPARTMENTAL ELECTIVE-VI

TOTAL QUALITY MANAGEMENT (TQM)

UNIT -I:
Quality Concepts:
Evolution of Quality control, concept change, TQM Modern concept, Quality concept in design.
Control on Purchased Product:
Procurement of various products, evaluation of supplies, capacity verification, Development of sources, procurement procedure.
Manufacturing Quality:
Methods and Techniques for manufacture, Inspection and control of product, Quality in sales and services, Guarantee, analysis of claims.

UNIT -II:
Quality Management:
Organization structure and design, Quality function, decentralization, Designing and fitting organization for different types products and company, Economics of quality value and contribution, Quality cost, optimizing quality cost, seduction programme.
TQM Principles:
Leadership, strategic quality planning; Quality councils - employee involvement, motivation; Empowerment; Team and Teamwork; Quality circles, recognition and reward, performance appraisal. Continuous process improvement; PDCE cycle, 5S, Kaizen; Supplier partnership, Partnering, Supplier rating & selection.

UNIT -III:
Tools and Techniques:
Seven QC tools (Histogram, Check sheet, Ishikawa diagram, Pareto, Scatter diagram, Control chart, flow chart).
Control Charts:
Theory of control charts, measurement range, construction and analysis of R charts, process capability study, use of control charts, P-charts and C-charts.

UNIT -IV:
Defects Diagnosis and Prevention:
Defect study, identification and analysis of defects, corrective measure, factors affecting reliability, MTTF, calculation of reliability, Building reliability in the product, evaluation of reliability, interpretation of test results, reliability control, maintainability, zero defects, quality circle.

UNIT -V:
ISO and its concept of Quality Management:
Quality systems, need for ISO 9000, ISO 9001-9008; Quality system- elements, documentation, Quality auditing, QS 9000, ISO 14000- concepts, requirements and benefits. TQM implementation in manufacturing and service sectors, Auditing, Taguchi method, JIT in some details.

Books and References:
7. Total Quality Management by Mukherjee, P.N.
FLEXIBLE MANUFACTURING SYSTEM

UNIT-I:
Planning, scheduling and control of flexible manufacturing systems:

UNIT-II:
Computer control and software for flexible manufacturing systems:

UNIT-III:
FMS simulation and data base:

UNIT-IV:
Group technology and justification of FMS:

UNIT-V:
Applications of FMS and factory of the future:

Books and References:
UNIT-I:
Overview of reliability engineering:
Definition of reliability, Failures & failures modes, Failure rates, MTTF, MTBF, Bath tub curve, Definition and factors influencing system effectiveness, various parameters of system effectiveness.

UNIT-II:
Reliability analysis:
Reliability Mathematics, Definition of probability, laws of probability, conditional probability.
Bay's theorem, Various probability distributions, Data collection, Recovery of data, Data analysis Procedures, Empirical reliability calculations.

UNIT-III:
Types of reliability:
Reliability types, System of series, parallel, series parallel, stand by and complex systems.
Development of logic diagram, Methods of reliability evaluation; Cut set and tie set methods, Matrix methods, Event trees and fault trees methods, Reliability evaluation using probability distributions.

UNIT-IV:
Improvement in reliability:
Reliability Improvements: Methods of reliability improvement, component redundancy, system redundancy, types of redundancies-series, parallel, series - parallel, stand by and hybrid, effect of maintenance.

UNIT-V:
Testing methods:
Reliability Testing, Life testing, requirements, methods, test planning, data reporting system, data reduction and analysis, reliability test standards.

Books & References:
UNIT-I:
Should You Become an Entrepreneur?
What Skills Do Entrepreneurs Need?
Identify and Meet A Market Need.
Entrepreneurs in A Market Economy.
Select A Type of Ownership.

UNIT-II:
Develop A Business Plan.

UNIT-III:
Choose Your Location and Set Up for Business.
Market Your Business.
Hire and Manage A Staff.

UNIT-IV:
Finance, Protect and Insure Your Business.
Record Keeping and Accounting.
Financial Management.

UNIT-V:
Meet Your Legal, Ethical, Social Obligations.
Growth in Today’s Marketplace.

Books &References:
2. Innovation and Entrepreneurship by Peter Drucker.
3. Running Lean: Iterate from Plan A to a Plan That Works by Ash Maurya.
4. The Ten Faces of Innovation by Tom Kelley and Jonathan Littman.
5. The Innovator’s Dilemma by Clayton M. Christensen.
6. The Invisible Advantage: How to Create a Culture of Innovation by Soren Kaplan.