Syllabus and Scheme of Master of Technology

(Production Engineering)

July, 2017

Department of Mechanical Engineering

Course of Study and Scheme of Examination
M. Tech. (Production Engineering) (Grading system, w.e.f. July 2017)
Semester – I

S. No.	Subject Code	Subject Name & Title	Maximum Marks Allotted						Credit Allotted Subject wise			Total credit	Remarks
			Theory Slot			Practical Slot		Total Marks	Period per week				
			End Sem	Mid Sem (Two tests average)	Quiz / assignment	End Sem/ Practical / Viva	Practical Record / Assignment / Quiz/ presentation		L	T	P		
1.	560101	Optimization Techniques In Mechanical Engineering	70	20	10	--	--	100	3	1	--	4	
2.	560102	Integrated Manufacturing & Resources Planning	70	20	10	--	--	100	3	1	--	4	
3.	560103	Production Engineering- I	70	20	10	--	--	100	3	1	--	4	
4.	560104	Production & Operation Management	70	20	10	--	--	100	3	1	--	4	
5.	560105 560106 560107 560108	Elective – I	70	20	10	--	--	100	3	1	--	4	
6.	560109	Simulation & Modeling Lab. -I	--	--	--	90	60	150	0	0	6	6	
7.	560110	Production Engineering Lab. – I	--	--	--	90	60	150	0	0	6	6	Grand Total
		Total	350	100	50	180	120	800	15	5	12	32	800

Elective – I:

560105	Ergonomics and Work Study	560107	Reliability Availability and Maintainability
560106	Project Management	560108	World-Class Manufacturing

Course of Study and Scheme of Examination
M. Tech. (Production Engineering) (Grading system, w.e.f. July 2017)
Semester – II

S. No.	Subject Code	Subject Name & Title	Maximum Marks Allotted						Credit Allotted Subject wise			Total credits	Remarks
			Theory Slot			Practical Slot		Total Marks	Period per week				
			End Sem.	Mid Sem (Two tests average)	Quiz Assignment	End Sem/ Practical / Viva	Practical Record / Assignment /Quiz /presentation		L	T	P		
1.	560201	Automation & Robotics in Production	70	20	10	--	--	100	3	1	--	4	
2.	560202	Advanced Statics & System Reliability	70	20	10	--	--	100	3	1	--	4	
3.	560203	Production Engineering-II	70	20	10	--	--	100	3	1	--	4	
4.	560204	Total Quality Management	70	20	10	--	--	100	3	1	--	4	
5.	560205 560206 560207 560208	Elective-II	70	20	10	--	--	100	3	1	--	4	
6.	560209	Computer Lab-I	---	---	---	90	60	150	0	0	6	6	
7.	560210	Production Engineering Lab-II	---	---	---	90	60	150	0	0	6	6	Grand Total
		Total	350	100	50	180	120	800	15	5	12	32	800

Elective – II

560205	Engineering Estimation & Costing	560207	Concurrent Engineering
560206	Flexible Manufacturing System	560208	Logistics & Supply Chain Management

Course of Study and Scheme of Examination
M. Tech. (Production Engineering) (Grading system, w.e.f. July 2018)
Semester –III

S. No.	Subject Code	Subject Name & Title	Maximum Marks Allotted						Credit Allotted Subject wise			Total credits	Remarks
			Theory Slot			Practical Slot		Total Marks	Period per week				
			End Sem.	Mid Sem (Two tests average)	Quiz/ Assignment	End Sem/ Practical / Viva	Practical Record / Assignment /Quiz /presentation		L	T	P		
1.	560301	Computer Integrated Manufacturing	70	20	10	--	--	100	3	1	--	4	
2.	560302	Maintenance Management	70	20	10	--	--	100	3	1	--	4	
3.	560303	Seminar	--	--	--	--	100	100	--	--	4	4	
4.	560304	Dissertation Part – I (Literature review / Problem Formulation/ Synopsis)	--	--	--	120	80	200	--	--	8	8	Grand Total
		Total	140	40	20	120	180	500	6	2	12	20	500

Course of study and Scheme of Examination
M. Tech.(Production Engineering) (Grading system, w.e.f. July 2018)
Semester –IV

S. No.	Subject Code	Subject Name & Title	Maximum Marks Allotted						Credit Allotted Subject wise			Total credits	Remarks
			Theory Slot			Practical Slot		Total Marks	Period per week				
			End Sem.	Mid Sem (Two tests average)	Quiz Assignment	End Sem/ Practical / Viva	Practical Record / Assignment /Quiz /presentation		L	T	P		
1.	560401	Dissertation Part- II	--	--	--	300	200	500	--	--	20	20	Grand Total
		Total	--	--	--	300	200	500	--	--	20	20	500

560101: Optimization Techniques in Mechanical Engineering

Category	Title	Code	Credit-4			Theory Paper
Department Core-DC	Optimization Techniques In Mechanical Engineering	560101	L	T	P	Max.Marks-70 Min.Marks-28 Duration-3hrs.
			3	1	0	

Course Objectives: To make the student to understand:

1. To understand the theory of optimization methods and algorithms developed for solving various types of optimization problems
2. To develop and promote research interest in applying optimization techniques in problems of Engineering and Technology
3. To make the learners aware of the importance of optimizations in real scenarios
4. To provide the concepts of various classical and modern methods for constrained and unconstrained problems in both single and multivariable
5. To apply the mathematical results and numerical techniques of optimization theory to concrete Engineering problems

Syllabus

Unit 1: Review of LPP, Revised simplex, Traveling Salesman problem (TSP), Non-linear programming problem; Introduction, classical optimization techniques, Non-linear programming methods, Knhn-Tucker condition.

Unit 2: Dynamic programming, Geometric programming , Basic concept, Bellman's optimality principles, Dynamic programming approach in Decision making problem, subdivision problem, solution of LPP by Dynamic method. Basic concept of Geometric programming and its formulation necessary condition for optimality, orthogonally and normality conditions.

Unit 3: Queueing Theory: Introduction to Queuing theory, classification of Queueing models, (M/M/1): (∞/FCFS), (M/M/1): (N/FCFS), (M/M/S): (∞/FCFS), optimization of service rate, littles formula and application of Queueing model for manufacturing/ production system, machine repair problem.

Unit 4: Game Theory: Introduction to game theory, pure & mixed strategy, maximin and minimax criterion of optimality, saddle point, Dominance property, solution methods of games without saddle point, algebraic & graphical method, and L.P.P. method for 3X 2 matrix.

Unit 5: Inventory & replacement Theory: Introduction to inventory models, classification of inventories, Deterministic control models, Probabilistic control models, single period probabilistic model without setup cost, and general single period model of profit maximization with time in dependent cost. Introduction to replacement and maintenance model, replacement of a machine whose maintenance cost is increasing with time, group replacement.

Course Outcome: After successful completion of this course students will be able to:

1. **Describe** the methods of Replacement theory and Probabilistic models
2. **Solve** various constrained and unconstrained problems in single variable as well as multi variables.
3. **Apply** the methods of optimization in real life situation.
4. **Analyze** optimization problems
5. **Compare** concept of optimality criteria for various type of optimization problems.
6. **Design** products by application of optimization.

Text & References Books:

1. B.E.Gillet, Introduction to Operation Research, Computer oriented algorithmic approach, Tata McGRAWHILL Publishing company NEW Delhi.
2. J.K.sharma, Operations Research theory and Application, McMilan.
3. E. J. Haug and J.S. Arora, Applied Optimal Design, Wiley, New York.
4. Kalyanmoy Deb, Optimization for Engineering Design, Prentice Hall of India
5. A. Ravindran and K.M. Rogsdeth, Optimization G.V. Reklaites, Wiley, New York

560102: Integrated Manufacturing and Resource Planning

Category	Title	Code	Credit-4			Theory Paper
Department core-DC	Integrated Manufacturing and Resource Planning	560102	L	T	P	Max.Marks-70 Min.Marks-28 Duration-3hrs.
			3	1	0	

Course Objective: To make the student to understand:

1. use of computers in the area of manufacturing to reduce manual processing and linking computers to all the manufacturing machines
2. productivity concept, reduce the unnecessary costs
3. Group technology, computer aided process planning, material requirement planning (MRP), Enterprise resource planning (ERP)
4. Concept of Computer aided quality control, Flexible manufacturing systems and Expert systems
5. Emerging trends in manufacturing such as Lean and Agile manufacturing

Syllabus

Unit- I Concept, objective, structure, Benefits & operations of IMS / FMS. Types of FMS, Technology of integrated manufacturing, types of automation, Automated manufacturing system, Automated inspection system, machine center. Flexibility concept and design of flexible workstation.

Unit-II Decision and choice regarding configuration requirement & selection of different system components, data file & report, inspection and measurement.

Unit-III Design planning and informational requirements of FMS/ IMS, tooling strategies.

Unit-IV Integrated resource planning, capacity planning, resource profile, and cause analysis of remedial decision for breaking bottlenecks, shop floor control & computer process monitoring.

Unit-V planning & design of futuristic factories, emerging trends in manufacturing such as agile manufacturing, learn manufacturing, Virtual manufacturing etc.

Course Outcomes: After successful completion of this course students will be able to:

1. **Discuss** about Computer Aided Quality control and Process Planning Control.
2. **Identify** the main elements in manufacturing systems.
3. **Apply** knowledge about various methods of communication in CIMS
4. **Analyze** data management and its importance for decision making in CIMS environment
5. **Discover** emerging trends of manufacturing in factories.
6. **Design** Flexible manufacturing cell after carrying out Group technology study and finally creating FMS

Text & References Books:

1. Groover, M.P., "Automation, Produ tion System and CIM", Prentice-Hall of India.
2. Principles of computer integrated manufacturing- S, Kant Vajpayee, PHI Learning Private Limited,New Delhi.
3. David Bedworth, "Computer Integrated Design and Manufacturing", TMH, New Delhi,
4. Yorem Koren, "Computer control Manufacturing Systems", McGraw Hill, .
5. Ranky, Paul G., "Computer Integrated Manufacturing", Prentice Hall International

560103: Production Engineering- I

Category	Title	Code	Credit-4			Theory Paper
Departmental Core-DC	Production Engineering- I	560103	L	T	P	Max.Marks-70 Min.Marks-28 Duration-3hrs.
			3	1	--	

Course Objective: To make the student to understand:

1. the basic principles and methods utilized in the joining and welding technology of engineering materials
2. how to handle welding equipment and weld/join materials practically
3. how to analyze, implement and maintain manufacturing system
4. methods of metal casting, casting defects and Gating system
5. methods of Moulding process, pattern design

Syllabus

Unit-I Introduction: - Metal casting vis-a-vis other processes, casting problems, design and introduction of moulds, melting, refining and pouring and liquid metal. Mechanism and Rate of Solidification on Metals and Alloys: - Nucleation and growth in pure metals and alloys, Solidification, solidification in actual castings, feeding resistance, rate of solidification.

Unit-II Riser Design and Placement: - Riser designs chvorinov's caines, NRL methods, placement of risers, effects of complex section and chills, case studies.Gating Design: - Gating principles, vertical gating, aspiration effects and its prevention, bottom gating system, horizontal-gating system, and case studies.

Unit-III Mould Production and Pattern Design: - Conventional moulding and core making processes, new moulding processes viz. Cold box, hot box, and vacuum moulding etc. pattern design considerations.

Die-Castings: - Recent trends, recasting, shell, lined die casting, ferrous die-casting. Non Mould materials and mould metal reactions: Structure of silica clay, various types of bonds, mould metal reactions, recent trends such as sand deformability index, role of atmospheres etc.Casting Design Considerations and Casting Defects: - Various casting design factors, casting defects, their causes and remedies.

Unit-IV Welding Technology: - Welding as compared with other fabrication processes, classifications of welding processes, fusion and pressure welding processes, weld-ability of metals, and metallurgy of welding. Weld design, stress distribution and temperature fields in the welds. Metal transfer and melting rate, recent developments in welding, explosive welding, laser beam welding, radio frequency induction welding etc. Specific application of welding e.g. cladding, metallizing, surfacing and fabrication.

Unit-V Welding of plastics, welding defects and inspection of welds, thermal cutting of metals, processes used for thermal cutting of metals. Recent developments in thermal cutting processes, cutting of cast iron, stainless steel and non-ferrous metals. Use of thermal cutting in fabrication of process machines and pressure vessels etc. Economics of welding: welding cost, productivity, post welding operations, standard time for welding & flame cutting, standard time & cost calculations.

Course Outcome: After successful completion of this course students will be able to:

1. **Describe** the causes of welding defects and how it can be prevented.
2. **Use** the basic manufacturing methods, measurements, automation and quality control.
3. **Apply** the principles of metallurgy during the welding process.
4. **Demonstrate** safe work habits that reflect concern and care for self, others and the environment.
5. **Employ** the principles of Moulding, casting and Gating design.
6. **Perform** any of the metal joining techniques (welding, brazing and soldering) conveniently

Text & References Books:

1. Welding Processes & Technology - Dr. R.S. Parmar, Khanna Publishers, New Delhi.
2. Production Technology - R.C. Patel & C.G. Gupte, (Vol III) C. Jamnadas & Co. Mumbai
3. Welding Technology & Design - V. M. Radhakrishnan, Newage International (P) Ltd, Pub. N. Delhi
4. Welding Skills & Technology - Dave Smith, Gregg Division, MCGRAW- Hill Book Company

560104: Production and Operations Management

Category	Title	Code	Credit-4			Theory Paper
Departmental Core-DC	Production and Operations Management	560104	L	T	P	Max.Marks-70 Min.Marks-28 Duration-3hrs.
			3	1	0	

Course Objective: To make the student to understand:

1. The role of operations management in the overall business strategy of the firm
2. Principles and applications relevant to the planning, design, and operations of manufacturing firms
3. How Enterprise Resource Planning and MRPII systems are used in managing operations
4. Layout planning, assembly line balancing and Inventory control system
5. The application of operations management policies and techniques to the service sector as well as manufacturing firms

Syllabus

Unit-I Introduction: - Functions within business organizations: Production, finance, marketing and other functions. The production management functions; design and operation of production system. Classification of production systems.

Forecasting: - Features common to all forecasts. Approaches to forecasting. Forecasts based on judgment and opinions. Analysis of time series data. Accuracy and control of forecasts. Choosing a forecasting technique.

Unit-II Design of Production Systems: - Capacity planning- importance of capacity decisions, defining and measuring capacity, determining capacity requirements.

Location Planning: - The need for location decisions, location factors evaluating alternative location.

Unit-III Layout Planning: - Need for layout decisions, basic layout types, designing layouts, assembly line balancing, computer-aided layout planning.

Product Design: - Need for product design, research and development, diversification, simplification, evaluation, standardization, reliability.

Unit-IV Work System Design: - Job design, work measurement, method study, work sampling, standard data, PMT system, operation and control of production system: intermediate-range planning - nature and scope of aggregate planning, techniques for aggregate planning.

Inventory Management: - Requirements for effective inventory management, EOQ models, quantity discount, safety stock, inventory control systems.

Unit-V Probabilistic Inventory Models: - MRP- An overview of MRP, MRP processing, MRP outputs, benefits and limitations of MRP. MRPI, MRP-II. Scheduling & Sequencing: -

Scheduling in high-volume systems; Scheduling & Sequencing in job shops. Criteria used in job shop models.

Course Outcomes: After successful completion of this course students will be able to:

1. **Apply** core features of the operations and production management function at the operational and strategic levels, specifically the relationships between people, process, technology productivity and quality
2. **Discuss** core features of the operations and production management function at the operational and strategic levels, specifically the relationships between people, process, technology productivity and quality
3. **Analyze** Forecasting technique and layout planning
4. **Use** the Inventory models and job shop models in Industries

5. **Apply** the 'transformation model' to identify the inputs, transformation processes and outputs of an organization
6. **Describe** the boundaries of an operations system, and recognize its interfaces with other functional areas within the organization and with its external environment.

Text & References Books:

1. G. Free-Bell and J Balkwill. Management in Engineering. Prentice-Hall of India (P) Ltd, New Delhi, Second edition.
2. E S Buffa and Sareen Production and Operations Management. New Age International (P) Ltd. New Delhi.
3. W J Sivanesan Production/Operations Management. Richard D Irwin Inc.
4. J L Riggs. Production Systems: Planning Analysis and Control. John Wiley & sons New York, forth edition.
5. Production & Operations Management by Dr KC Arora, Laxmi Publications, New Delhi.

560105: Ergonomics and Work Study

Category	Title	Code	Credit-4			Theory Paper
Elective-1	Ergonomics and Work Study	560105	L	T	P	Max.Marks-70 Min.Marks-28 Duration-3hrs.
			3	1	0	

Course Objective: To make the students to understand:

1. Concept and significance of work study and ergonomics.
2. Various techniques of work-study for improving the productivity of an organization.
3. Existing methods of working on the shop floor of an organization.
4. Allowances, rating, calculation of basic and standard time for manual operations in an organization.
5. Work place design, working postures and lifting tasks.

Syllabus

Unit -I Human being in Man Made World, Gross Human Anatomy, Anthropometrics, Static and Dynamic, Muscles and Work Physiology, Static and Dynamic Work including Maximum Capacity.
Unit-II Biomechanics, Environmental Condition including Thermal, Illumination Noise and Vibration, Biological Transducer and Nervous system including their Limitations. Control and Displays Psycho Physiological aspects of Design. Research Techniques in Ergonomics .Generation. Interpretation and application as statistical Methods. Case Analysis
Unit-III Method Study: - Selection of Problem, Application of critical examination techniques. Preparation of work Study Reports, Development of improved methods, preparation for and presentation of improved methods, implementation of improved methods, follow-up techniques and report.
Unit-IV Work Measurement: - Work Sampling. Fundamental statistical concepts sample size, procedure for making a work sampling study, determining time standards by work sampling, practical applications, advantages and disadvantages.
Unit-V Micro Motion Study. PMTS. MTM Systems work factor system and Production Incentives

Course Outcome: After successful completion of this course students will be able to:

1. **Identify** potential and current OH&S hazards in the workplace relating to ergonomics issue.
2. **Describe** relation between human motion and industry.
3. **Calculate** the production capacity of man power of an organization.
4. **Analyze** the level of risk in a job causing stress, fatigue and musculoskeletal disorders and design appropriate work systems.
5. **Devise** appropriate wage and incentive plan for the employees of an organization.
6. **Design** physical and psychosocial work system and work places.

Text & References Books:

1. Barnes Ralph M., "Motion & Time study: Design and Measurement of Work", Wiley Text Books, 2001.
2. Lakhwinder Pal Singh, “Work Study and Ergonomics” CAMBRIDGE , 2010.
3. S.K. Sharma Savita Sharma , “Work Study and Ergonomics” S K Kataria and Sons 2006.
4. P.C.Tiwari, “Work Study and Ergonomics” CRC Press , 2004.
5. Suresh Dalela and Saurabh Dalela, “Work Study and Ergonomics” CRC Press , 2001.

6. Marvin E, Mundel & David L, "Motion & Time Study: Improving Productivity", Pearson Education,2000.
7. Benjamin E Niebel and Freivalds Andris, "Methods Standards & Work Design", Mc Graw Hill, 1997.
8. Work Study-Shan
9. Work Study – Sharma

560106: Project Management

Category	Title	Code	Credit-4			Theory Paper
Elective-1	Project Management	560106	L	T	P	Max.Marks-70
			3	1	--	Min.Marks-28
						Duration-3hrs.

Course Objective: To make the student to understand:

1. business concepts and tools to facilitate project success
2. appropriate legal and ethical standards
3. Calculations of PERT/CPM and linear programming
4. The concept of Project auditing, project appraisal and project monitoring
5. the fundamentals and recent trends in project management and performance criteria

Syllabus

Unit-I Introduction to project management, Project selection
Unit-II The Project Manager, Project Organization.
Unit-III Project Planning and Resource allocations, activity networks, basic PERT/CPM calculations, planning and scheduling of activity networks, assumptions in PERT modelling, time-cost trade-offs.
Unit-IV Linear programming and network flow formulations; PERT/Cost accounting, scheduling with limited resources. Generalized activity networks, Gantt./bar, Mill stone chart Prospects of PERT/CPM,
Unit-V Project appraisal Project Monitoring, Project Control and Project auditing, and selection, recent trends in project management.

Course Outcome: After successful completion of this course students will be able to:

1. **Identify** project goals, constraints, deliverables, performance criteria, control needs and resource requirements
2. **Implement** project management knowledge, processes, lifecycle and the embodied concepts, tools and techniques
3. **Apply** appropriate legal and ethical standards
4. **Appraise** the role of project management in organization change.
5. **Develop** plans with relevant people to achieve the projects goals.
6. **Implement** general business concepts, practices, and tools to facilitate project success

References books

1. Project management, Jack R. Meredith & Samnel J. Mantel, Jr.; John Wiley & Sons
2. Harrison "Advanced Project Management" F.L.-. Metropolitan Book Co., N. Delhi.
3. Kezner, Harold- "Project Management" Van Nostrant Reinghold: Newyork
4. Levine, Harvey A. "Project Managing using Micro computers"
5. Moder J. J. Phillips CR and EW Davis "Project Management with CPM, PERT and Precedence Drawings" CBS Publishers, New Delhi.
6. Saxena KR (ed.) 1991"Project Management for Developing Countries"
7. Weigsht Jerome D and Ferdinand K. Levy, "A Management guide to PERT/CPM" Prentice Hall of India. New Delhi.
8. Engineering Project Management by Parameshwar P. Iyer, Apex Publishing, Charutha 7/119- 1, Puthur Road, Palakkad,

560107: Reliability Availability and Maintainability

Category	Title	Code	Credit-4			Theory Paper
Elective-1	Reliability Availability and Maintainability	560107	L	T	P	Max. marks: 70 Min. Marks: 28 Duration: 3 hrs
			3	1	--	

Course objectives: To make the student to understand:

1. Various Reliability concepts underlying the application of reliability based approaches to the formulation of maintenance strategy and effective process evaluation
2. statistical tools to characterize the reliability of an item
3. Standby models, multi-state models and reliability tests
4. the ability to select appropriate reliability validation methods
5. working knowledge to determine the reliability of a system and suggest approaches to enhancing system reliability

Syllabus

Unit-I Reliability of Concept: - System reliability, importance of reliability, types of failure, failure probability distribution. MTTF MTBF, correlation between operation time and other life parameters, Reliability is terms of hazard rate and failure density, Markovion processes.

Unit-II Reliability of Maintained & Non Maintained Systems: - Fundamental definition, single equipment system, series, parallel, series parallel configurations, K-out of as a System, standby models, Multi-state models, steady state availability modeling of maintained systems, various methods for reliability evaluation of complex system.

Unit-III Reliability Improvement & Testing: - Proper design and simplicity component improvement testing creative design, redundancy, stand by redundancy test plans, failure consorted, time consorted and sequential reliability tests, Accelerated life test, environmental test. Reliability estimation.

Unit-IV Availability and Maintainability- Introduction and Application

Unit-V Design for Maintainability & Reliability

Course outcomes: After successful completion of this course students will be able to:

1. **Analyze** the interference between strength and stress, or life data for estimating reliability
2. **Carryout** a failure mode effect and criticality analysis
3. **Apply** the appropriate methodologies and tools for enhancing the inherent and actual reliability of components and systems, taking into consideration cost aspects
4. **Implement** multi-state models and reliability tests
5. **Apply** learned concepts to improving the maintenance, maintainability, hazard risk and safety of plant
6. **Justify** the life cycle of component on the basis of Reliability and maintainability.

Text & References Books:

1. A.K. Gupta “Reliability Engineering and Terotechnology", Macmillan India Ltd., New-Delhi
2. Reliability Centered Maintenance by Jjohn Moobure.
3. Charles E. Ebeling “An Introduction to Reliability and Maintainability Engineering " Tata Macgraw Hill
4. Reliability Engineering by L.S. Srinath

5. Lectro- Mechanical System Theory by Keonic H.P. & Bach wall W.A.
6. Analysis of Discrete Physical Systems by Koening H. E.

560108: World-Class Manufacturing

Category	Title	Code	Credit-4			Theory Paper
Elective-1	World-Class Manufacturing	560108	L	T	P	Max. marks: 70 Min. Marks: 28 Duration: 3 hrs
			3	1	--	

Course objectives: To make the student to understand:

1. About the concept and significance of corporate strategy.
2. About various techniques of Operating strategies - Methodological frame work -Lean production.
3. Existing methods of working on the shop floor of an organization.
4. About various Flexibility in context of manufacturing Strategy.
5. Reengineering- Rethinking Business processes.

Syllabus

Unit-I Manufacturing Strategy: - Corporate strategy- Missing the links in manufacturing strategy - Audit approach -Restructuring -Manufacturing strategy process in practice - Operating strategies - Methodological frame work -Lean production - Strategies in Hungary - Strategies in Europe - Competitive priorities - Strategic value of response time and product variety - Flexibility in context of manufacturing Strategy.

Unit-II Re-Engineering: - Introduction - Reengineering- Rethinking Business processes- The New World of Work- Role of IT- who will Re-engineer? The hunt for Re-Eng. opportunities - The exp. of process of redesign.

Unit-III JIT: - An Introduction -Toyota Kanban Production System –Design Principle of JIT, OPT Development and management of JIT Manufacturing systems-Implementation of JIT.

Unit-IV Supply Chain Management Information System & Monitoring

Unit-V Lean, Agile, Virtual Manufacturing.

Course outcomes: After successful completion of this course students will be able to**:**

1. **Define** the concept and the importance of manufacturing strategy for industrial enterprise competitiveness
2. **Apply** the appropriate techniques in the analysis and evaluation of company's opportunities for enhancing competitiveness in the local, regional and global context
3. **Familiarized** with supply Chain management and emerging trends in manufacturing
4. **Apply** the concept of JIT and re-engineering principle in Industries
5. **Identify**, formulate and implement strategies for manufacturing and therefore enterprise competitiveness.
6. **Evaluate** the information system of supply chain management.

Text & References Books:

- Voss C.A., "Manufacturing Strategy: Process and Content", Chapman & Hall, London,
- Jim Todd, "World-class Manufacturing", McGraw Hill, London.
- Voss C.A., "Manufacturing Strategy: Process and Content", Chapman & Hall, London
- Michel Hammer & James Champy, "Reengineering the Corporation, Nicholas Brealely, London.
- "TPM Edited Notes", by Japan Institute of Plant Maintenance

- (a) Besterfield D H, et. al., "Total Quality Management", PHI, New Jersey.
  (b) Johan S Okland, "Total Quality Management: Text with Cases"
- M G Korgaonker, "Just in Time Manufacturing", Macmillan India Ltd. New Delhi
- Lambert D M, "Fundamentals of Logistics Management", Irwin/ McGraw-Hill, USA
- Kim Todd, "World-class Performance", McGraw Hill, London

560201: Automation & Robotics in Production

Category	Title	Code	Credit-4			Theory Paper
Departmental core-DC	Automation & Robotics in Production	560201	L	T	P	Max. marks: 70 Min. Marks: 28 Duration: 3 hrs
			3	1	--	

Course objectives: To make the student to understand:

1. The automation and brief history of robot and applications
2. About robot end effectors, Robot Programming methods & Languages of robot.
3. Various sensors and fundamentals of vision systems.
4. The latest material handling system used in manufacturing industry and the concept of Automated Guided Vehicle System.
5. The basics of CAD/CAM integration and concept of the group technology

Syllabus

Unit-I Automation: - Definition, Reasons for automating, Types of production Automation Strategies, Detroit type Automation - Automated flow lines, Method for work part Transport, Transfer mechanism, Buffer storage, control functions, automation for Machining operations, design and fabrication considerations

Unit-II Automated Inspection & Testing: - Inspection and testing, SQC, automated inspection - Principles and methods, Sensor technologies for automated inspection, coordinate Measuring machine, other contact inspection method, machine vision, optical inspection methods, and non-contact inspection methods.

Unit-III Introduction to Robotics: - Historical development, specification, Configuration Drive and Precision of Industrial Robots, Robot end- effecters. Robots Kinematics, Direct and Inverse, Robot trajectories, Control of Robots Manipulators. Sensing: Range proximity, Touch, Force , Torque, Surface texture and vision.

Robot Programming: - Robot languages, Robot teaching. Robot level languages, Task level languages and offline programming, concept of AI in Robotics.

Unit-IV Robot Application Planning: - Product design and production planning, principles of Robot's motion economy, design of robotic workstations Performance analysis. Justification of industrial robots.

Unit-V Industrial Application of Robots: - Selection and use of Robots for foundry and casting, welding materials handling, machining inspection, assembly and painting.

Course outcomes: After successful completion of this course students will be able to**:**

1. **State** the concepts/components of computer integrated manufacturing and integrate them in a coordinated fashion
2. **Identify** the main elements in computer integrated manufacturing systems.
3. **Apply** computer aided process planning, feature and group technology, and data exchange in manufacturing processes.
4. **Analyze** product models with CAM tools and CNC machines.
5. **Select** the standard machining codes of programming for different materials
6. **Design** Flexible manufacturing cell after carrying out Group technology study and finally creating FMS.

Text & References Books:

1. Robotics, Controlling, Sensing, Vision & Intelligence by FU K.S. Gonzalez & Lee; McGraw Hill Book Co.

2. Robotics for Engineers, by Yoren Koren, McGraw Hill Book Co. New York.
3. Groover, M.P., "Automation, Production System and CIM", Prentice-Hall of India.
4. Principles of computer integrated manufacturing- S, Kant Vajpayee, PHI Learning Private Limited,New Delhi.
5. David Bedworth, "Computer Integrated Design and Manufacturing", TMH, New Delhi
6. Yorem Koren, "Computer control Manufacturing Systems", McGraw Hill.
7. Ranky, Paul G., "Computer Integrated Manufacturing", Prentice Hall International.

560202: Advanced Statistics and System Reliability

Category	Title	Code	Credit-4			Theory Paper
Departmental core-DC	Advanced Statistics and System Reliability	560202	L	T	P	Max. marks: 70 Min. Marks: 28 Duration: 3 hrs
			3	1	--	

Course objectives: To make the student to understand:

1. Mathematical and logical methods to solve problems
2. A variety of statistical methods for making inferences
3. System Reliability concept Hazard rate, series and parallel systems
4. discrete and continuous probability distributions to various business problems
5. Which kinds of problems in the real world can be solved using statistical methods

Syllabus

Unit – 1 Theory of Probability: Basic concepts of probability, Probability density function, discrete and continuous. Probability distributions (Binomial, Poisson, Exponential, Normal, Exponential, Weibull, Gamma, Beta, Ray-leigh)

Unit – 2 Random Variable: Concept of Random variable, one dimensional Random variable, two dimensional Random variable, distribution function, Joint probability distribution function, Marginal probability distribution, cumulative probability distribution, correlation and regression, auto correlation function and its properties.

Unit – 3 Stochastic Processes: Markov process, Markov chain, classification of states, matrix transition probabilities, n-step transition probabilities, Chapman Kolmogorov equation, Gambler's Ruin theorem, Markovian Queueing model.

Unit – 4 System Reliability: Concepts of reliability, reliability function, MTTF, MTTR, MTBF, Hazard rate, series systems, parallel systems, series parallel system reliability, reliability improvements.

Unit – 5 Maintainability & Availability: Concept of Maintainability, maintainability function, availability function, system Availability, K-out-of – m systems, preventive maintenance.

Course outcomes: After successful completion of this course students will be able to:

1. **Carry out** maximum likelihood estimation and inference in simple statistical models with several parameters.
2. **Apply** Stochastic process to derive approximate sampling distributions and confidence intervals for transformed estimators
3. **Calculate** an expectation of a random variable for a given distribution
4. **Familiarized** with System reliability, Hazard rate and maintainability function
5. **Calculate** a probability from a probability mass function of a discrete random variable and a binomial distribution.
6. **Implement** the concept of system reliability and maintainability

Text & References Books:

1. Stochastic Models: B.R. Bhatt.
2. Stochastic Process: J. Medhi.

3. Introduction to Probability Models: S. M. Ross.
4. Random Process: T. V. Rajan
5. System Reliability: Roy Billton

560203: Production Engineering-II

Category	Title	Code	Credit-4			Theory Paper
Departmental core-DC	Production Engineering-II	560203	L	T	P	Max. marks: 70 Min. Marks: 28 Duration: 3 hrs
			3	1	--	

Course objectives: To make the student to understand:

1. The basic understanding of unconventional machining processes
2. The principle, mechanism of metal removal of various unconventional Machining processes
3. 3D laser forming, parametric analysis for performance evaluation
4. Concept of MRR, feed rate and new hybrid non-traditional processes
5. The various process parameters and their effect on the component machined on unconventional machining processes

Syllabus

Unit-I Modern Manufacturing Methods: -Introduction: Shape building processes & overview of new manufacturing processes. Laser bending and 3D laser forming. Brief description of High-Energy Rate Forming (HERF) processes. Thermal Metal Removal Processes: -

Unit-II Electric Discharge Machining: - Principal of EDM, Spark generators, Dielectrics and Flushing, Tool feeding system. Performance Evaluation- MRR, Surface finish & Accuracy. Tool Designs: EWR, Over cut Tapers, Performance Improvement Techniques, Principles of Working and Application of EDD, TW-EDM, EDS, EDO, CNC-EDM, AC-EDM, HEDM and Pocket EDM.

Unit-III Laser Beam Machining: - Principal of laser production, Working principles of laser beam machining. Types of Lasers, Working of Ruby and Co-laser process characteristics, Advantages, Limitations and Applications of Electron Beam Machining (EBM), Ion Beam Machining (IBM) and Plasma Beam Machining (PBM).Mechanical Processes: -

Unit-IV Ultrasonic Machining: Principle of working, USM System, Mechanics of Cutting, Parametric Analysis, Process capabilities, Advantages, Limitations and Applications.

Abrasive Jet Machining: Principle of Working, AJM setup, Gas propulsion, Abrasive Feeder, Machining chamber and nozzle, Parameter analysis for performance evaluation, Process capabilities, advantages, Limitations and Applications. Working principle and applications of Abrasive Flow Machining (AFM), Magnetic Abrasive Machining (MAM), Water Jet Cutting (WJC), and Abrasive Water Jet Machining (AWJM), Abrasive Polishing and Hydraulic Jet Cutting.

Unit-V Electro Chemical Machining: Electrolysis, Theory and Working principle of ECM, Composition, Properties and selection of electrolyte ECM machine, tool-power source, Electrolyte supply and cleaning system, tool feed system, work holding systems. Material removal rate in ECM, Dynamics and Kinematics, Smoothing of an irregular anode surface, tool design for ECM. Limitations of ECM, Principles, applications of ECG, Electro-stream drilling (BSD), ECDE, shaped-tube Electrolytic machining (STEM). Basic Techniques of CHM, Maskants, CH Milling, CHB and Petrochemical Discharge Machining (PCDM). Comparison of new methods of machining. Introduction to Electro Chemical discharge Machining and other new hybrid non-traditional Processes. Micro-machining techniques and their applications.

Course outcomes: After successful completion of this course students will be able to:

1. **Define** the basic techniques of advance machining processes.
2. **Identify** the process parameters and their effects.

3. **Demonstrate** different unconventional machining processes and the influence of difference process parameters on the performance and their applications.
4. **Compare** the machining response of different unconventional machining process.
5. **Recommend** the best machining process for different materials of various applications.
6. **Improve** the machining response using optimization techniques

Text & References Books:

- Advance Methods of Machining by M G Gough, J.A, Chapmanand Hal London.
- Non-traditional Manufacturing Process Engineering by Gray F. Bendictm, MARCAL, DEKK.ER Inc.
- Modern Manufacturing Process Engineering by Niebe, Mc.Graw-Hill Int. Ed.
- New Technology by Bhattacharya, A.IE (I) Calcutta.
- Non-conventional Machining by Mishra, PK Narosa Publishing House, New Delhi.
- Modern Machining Methods by Adithan, S.Chand & Co. New Delhi.
- Modern Machining process by Pandey, PC and Shan, HS Tata Me Graw Hill, New Delhi.
- Manufacturing Science by Ghose, A & Malik, AK, EWP.
- Production Technology by HMT.
- Fundamentals of Machining and Machine Tools by Boothroyed Marcel, Dekker, Inc.
- ASM Metals Handbook, Vol. Number Machining.
- Production Technology by PC Sharma, S. Chand & Company Ltd.

560204: Total Quality Management

Category	Title	Code	Credit-4			Theory Paper
Departmental core-DC	Total Quality Management	560204	L	T	P	Max. marks: 70 Min. Marks: 28 Duration: 3 hrs
			3	1	--	

Course objectives: To make the student to understand:

1. The philosophy and core values of Total Quality Management (TQM)
2. How to evaluate best practices for the attainment of total quality
3. The concept of ISO 9000 and quality manual
4. The various methods of design and development to improve quality of product
5. Impact of quality on economic performance and long-term business success of an organization

Syllabus

Unit-I Introduction to ISO 9000 and TQM: - Quality, History of Quality, Total Quality, TQM, TQM Enablers. TQM Models, Quality Control, Computer Aided Quality Control, Customer Satisfaction, Customer Drives, Quality Circles, Customer Complaints, Types of Customers, Customers, Surveys.
World Class Quality Control: - Total Waste Elimination, Waste identification, Total Employees involvement, TEI Practice, Company wide quality control.

Unit-II TQM Gurus: - Deming, Juran, Crosby, Feighbaum, Ishikawa, Quality Assurance, Principles, forms,at different stages.Quality Assurance: - QA Programme, QA and top Management, QA department, Vendor rating

Unit-III Quality of Product Design and Development: - Methods for design and development, Integrated Product development, Quality of conformance, computer aided manufacturing quality.Next Generation: - Quality control in manufacturing, Quality improvement: Juran 7 Quality tools, Bench marking, types, Process, Quality leadership for TQM, TQM Implementation:- Juron Approach. Quality Organization Requirements, planning of quality organization.

Unit-IV Quality Manual for ISO 9000-2000: - QMS guideline, Management responsibility, Resource Management, Process Management, Measurement Analysis and Improvement.
Quality Cost: Evolution: - Time and Quality cost, Activity based costing, Quality cost collection, Quality cost analysis, Juran classical model for optimum quality levels.

Unit-V Quality Awards: - ISO Malcolm Baldrige National quality award, European quality awards, CH, EXIM award. ISO 14001 environment manual, ISO 18001 manual

Course outcomes: After successful completion of this course students will be able to:

1. **Discuss** about quality measures, Quality control techniques.
2. **Describe** various theories of Total quality management.
3. **Determine** the cost of poor quality and process effectiveness and efficiency to track performance quality.
4. **Apply** appropriate techniques in identifying customer needs, as well as the quality impact that will be used as inputs in TQM methodologies.
5. **Evaluate** the performance excellence of an organization, and determine the set of performance indicators
6. **Enhance** management processes, such as benchmarking and business process reengineering

Text & References Books:

1. TQM by Dr, K.C.Arora, S.K.Kataria and sons Publication, Delhi.
2. Jack Hiradsky TQM Hand book McGraw Hill New York
3. JH Taylor TQM Field Manual Me. Grew Hill Newyork
4. Chrisk Hakes: TQM-The key to business, Chapman and Holland.

560205: Engineering Estimation & costing

Category	Title	Code	Credit-4			Theory Paper
Elective-1	Engineering Estimation & costing	560205	L	T	P	Max. marks: 70 Min. Marks: 28 Duration: 3 hrs
			3	1	--	

Course objectives: To make the student to understand:

1. The major types of costing methods and budgeting operations that support engineering cost analysis and project/operations planning and control;
2. Concepts and techniques of economic analysis that can be applied to solving engineering and business problems;
3. EOQ models, tax and their impact in economic studies
4. Various issues in social discount rate costing
5. Methods that evaluate/support engineering projects and operations.

Syllabus

Unit-I Engineering Economy: - Introduction, decision-making, EOQ model basis economic concepts interest formulae, present worth rate of return, CRF, SFF

Unit-II Elements of Financial Accounting: - Depreciation, taxes and their impact in economic studies.

Unit-III Economic Analysis for Engineering Systems: - Replacement, maintenance etc, risk and uncertainty in Economic decisions; sensitivity analysis.

Unit-IV Public Project Evaluation and Issues Regarding Social Discount Rate Costing: - Introduction, financial and cost accounting, cost volume profit relationship, elements of cost, relevant costs, overhead costs, classification, absorption.

Unit-V Activity Based Costing

Course outcomes: After successful completion of this course students will be able to:

1. **Apply** costing principles and techniques to the planning and control of profitability in the production of goods and services in the engineering industry;
2. **Acquire** knowledge to prepare budget & production planning
3. **Estimate** the Total cost from Raw materials to finished product including Power cost
4. **Apply** the principles and techniques of economic analysis to the appraisal of investment alternatives;
5. **Apply** the foregoing techniques in the evaluation of engineering projects.
6. **Improved** analytical skill about the practice engineering

Text & References Books:

- Prassanna Chandra. Fundamentals of Financial Management. Tata Me Graw-Hill Publishing Co. Ltd. Second edition, New Delhi.
- EL Grant, et al. Principles of Enginering Economy. John Wiley & Sons, New York, Seventh edition.
- J L Riggs and T M West. Engineering Economics Me Graw-Hill Inc, NewYork,Third edition.
- J C Van Home. Financial Management and Policty Prentice-HAll of India (P) Ltd., New Delhi.

560206: Flexible Manufacturing System

Category	Title	Code	Credit-4			Theory Paper
Elective-1	Flexible Manufacturing System	560206	L	T	P	Max. marks: 70 Min. Marks: 28 Duration: 3 hrs
			3	1	--	

Course objectives: To make the student to understand:

1. Different types of manufacturing available today such as the Special manufacturing System, the Manufacturing Cell and the Flexible Manufacturing System
2. Material handling system, Cutting tools and tool management
3. Fundamentals of computer assisted numerical control programming and automated storage systems
4. Concept of Aggregate planning, single stage planning and multi stage planning
5. Common CAD/CAM data base organized to serve both design and manufacturing

Syllabus

Unit-I Introduction of CAD/CAM systems. Overview of FMS. System hardware and general functions.

Unit-II Material handling systems and automated storage/retrieval systems. Work holding system. Cutting tools and tool management.

Unit-III Physical planning of system, Aggregate Planning, Single stage planning & Multi stage planning.

Unit-IV Software structure functions and description. Cleaning and automated inspection. Communications and computer networks for manufacturing.

Unit-V Quantification of flexibility. Human factors in manufacturing. FMS and CIM in action. Justification of FMS. Modelling for Design. Planning and operation of FMS.

Course outcomes: After successful completion of this course students will be able to:

1. **Define** various workstations, system support equipments
2. **Identify** hardware and software components of FMS
3. **Familiarized** with single stage planning & multi stage planning
4. **Implement** planning and scheduling methods used in manufacturing system
5. **Summarize** the concepts of modern manufacturing such as JIT, supply chain management and lean manufacturing
6. **Perform** simulation on software's use of group technology to product classification

Text & References Books:

- Mikell P. Groover, Automation, Production Systems and CIM. "PHI
- Greenwood, "Implementation of FMS", MacMillan Edition.
- Talavage J. "FMS in Practice, Applications, design and Simulation", Marcel Dekker Inc.
- Ranky P.O. "Design and Operation of FMS", IPS Publications, UK.
- Hartely J. "FMS at Work", IPS Publications

560207: Concurrent Engineering

Category	Title	Code	Credit-4			Theory Paper
Elective-1	Concurrent Engineering	560207	L	T	P	Max. marks: 70 Min. Marks: 28 Duration: 3 hrs
			3	1	--	

Course objectives: To make the student to understand:

1. Basic principles of Concurrent engineering and various integrating mechanisms
2. About QFD methodology and design for manufacturing
3. About Rapid prototyping and design for reliability
4. About Design for Serviceability , Design for Maintainability and Design for Economics
5. Decomposition of design process, design optimization

Syllabus

Unit-I Introduction: - Definition of CE-Sequential verses CE -Need of CE-Basic Principles of CE-Benefits of Pit Falls of CE Implementation of CE -Integrating Mechanisms: - Introduction -Various Integrating Mechanisms.

Unit-II Quality by Design: - QFD-QFD Methodology -Taguchi Methods of Robust design.

Design for Manufacturing: - Introduction -PDS-Value Engineering -Design Guidelines -Design Axioms -Poka Yoke -Manufacturability Analyzer.

Unit-III Rapid Prototyping: - Introduction-Need & Use of RP-Various RP Technique -Design for Assembly introduction-Various DFA Techniques -Design for Reliability: - Introduction-Reliability Fundamentals -Reliability Analysis During Design -General Design for Reliability Principles

Unit-IVDesign for Serviceability: - Introduction-Serviceability -Factors affecting serviceability -Service modes -Serviceability evaluation Design for Maintainability: -

Design for Economics: - Introduction-Fundamental approaches to design -Economic Justification.

Unit-VDecomposition in CE: - Introduction- Decomposition of design Process-Decomposition of design constraints .An 1A based System for CE: - Introduction-An 1 A based frame work for CE-Conflict detection and Conflict -resolution KBE System in CE: - Role of KBE System -KBE System -KBE and Design Optimization

Course outcomes: After successful completion of this course students will be able to:

1. Identify the need of concurrent engineering and strategic approaches for product design.
2. Apply the QFD methodology and design for manufacturing.
3. Apply the rapid prototyping techniques and reliability principles.
4. Optimized the manufacturing lead time
5. Familiarized with design of serviceability, maintainability and economics
6. Perform the KBE and Design optimization

Text & References Books:

1. Kuldip Singh Sangwan, "Fundamentals Concurrent Engineering", EDD Notes
2. Chanan S. Syan & Unny Menon, "Concurrent Engineering: Concepts, implementation and practice" Chapman & Hall.
3. James L Nevins and Daniel E Whitney, Concurrent Design of Product and Processes, McGraw Hill.
4. Andrew Kusiak, Concurrent Engineering: Automation, Tools, and Techniques, WileyInterscience.
5. Groover, M.P., "Automation, Production System and CIM", Prentice-Hall of India.

6. Principles of computer integrated manufacturing- S, Kant Vajpayee, PHI Learning Private limited,New Delhi.
7. David Bedworth, "Computer Integrated Design and Manufacturing", TMH, New Delhi.

560208: Logistics and supply chain management

Category	Title	Code	Credit-4			Theory Paper
Elective-1	Logistics and supply chain management	560208	L	T	P	Max. marks: 70 Min. Marks: 28 Duration: 3 hrs
			3	1	--	

Course objectives: To make the student to understand:

1. The consumer demand for guaranteed delivery of high quality and low cost with minimal lead time
2. How to optimize pre and post production inventory levels
3. How to maintain transparency in operations
4. How to minimize variance by means of activities like standardization, variety reduction
5. How to achieve maximum efficiency in using labour, capital and plant through the company

Syllabus

Unit-I Introduction to Logistics: - Scope of Logistics, Elements of Logistics, Logistics in the system Life Cycle, Need for Logistics Engineering, Related Terms and Definitions.

Unit-II Measures of Logistics: - Reliability, Maintainability, Availability factors, Supply supports, Facility and Software Factors. System Engineering Process: - Definition of Problem and Need analysis, System Feasibility Analysis, System Operational Requirements, Functional Analysis.
Supportability Analysis: - Processes, Methods, Tools and Applications.

Unit-III Logistics in The Design and Development Phase: - Design Process, Related Design Discipline, Supplier Design Activities, Design Integration and Reviews, Test and Evaluation.
Logistics in The Production /Construction Phase: - Production/ Construction Requirements, Industrial Engineering and Operations Analysis, Quality Control, Production Operation, Transition from Production to user operation. Logistic in The Utilization and Support Phase: - System/ Product Support, TPM, Data collection, Analysis and System Evaluation, Evaluation of Logistic Support Elements, System Modification.

Unit-IV Logistics in the System Requirement, Material Recycling and Disposal Logistic Management: -Logistic Planning, Development of a Work Breakdown Structure, Scheduling of Logistics Tasks, Cost Estimation and control, Organization for Logistics, Management and control.
Unit-V Supply Chain Management: - Overview, Managing the customer interface. Managing the supplier interface. Measures of Supply chain performance, Supply Chain links to operations strategy, Supply Chain Dynamics, Supply Chain Software, Supply chain management across the organization

Course outcomes: After successful completion of this course students will be able to:

1. Apply sales and operation planning, MRP and Lean manufacturing concepts
2. Familiarized with managing the supplier interface
3. Analyze the manufacturing operations of a firm
4. Apply quality management tools or process improvement
5. Apply logistics and purchasing concepts to improve supply chain operations

Text & References Books:

1. Logistics Engineering and Management-Benjamin S. Blanchard.
2. Operation Manasement-Lee J Kraiewski & Larry P. Ritzman
3. Essentials of supply chain management by Michael H. Hugos

4. Logistics and supply chain management by Martin christopher
5. Supply chain management: strategy, planning and operation by sunil chopra and Peter Meindl.

560301: Computer Integrated Manufacturing

Category	Title	Code	Credit-4			Theory Paper
Departmental Core	Computer Integrated Manufacturing	560301	L	T	P	Max. marks: 70 Min. Marks: 28
			3	1	--	Duration: 3 hrs

Course objectives: To make the student to understand:

1. To use computers in the area of manufacturing to reduce manual processing and linking computers to all the manufacturing machines and increase the productivity, reduce the unnecessary costs.
2. To learn the computer numerical control, retrofitting of conventional machine tools, programming and feedback systems.
3. To understand the different controlling system, sensors and work holding devices.
4. To learn the CNC part programming, cost of machining operations and maintenance features.
5. To learn the overall configuration and Computerized Manufacturing Planning System.

Syllabus

Unit-I Production Operations & Automation Strategies: - Automation Defined, Types of Production Systems, Production Concepts and Mathematical Model , Automation Strategies . Fundamentals of CAD/CAM/CIM.

Unit-II Numerical Control Production System: - Types of NC Systems, MCU and other components of NC System, Applications, NC-Part Programming, (Manual & Computer Assisted) APT Language, Computer-Automated Part Programming, DNC, CNC, and Adaptive Control.

Unit-III Group Technology & Flexible Manufacturing Systems: - GT Part Families, Classification & coding, M/C Cell Design, Benefits of GT, FMS Workstations, Material Handling & Storage Systems, Computer Control System, Planning of FMS Analysis Methods.

Unit-IV Industrial Robotics: - Robotics Technology, Programming & Applications.

Unit-V Computerized Manufacturing Planning System: - Computer Aided Process Planning, Computer Integrated Production Planning Systems, Shop Floor Control.

Course outcomes: After successful completion of this course students will be able to:

1. **Identify** the main elements of computer numerical control manufacturing systems.
2. **Discuss** knowledge about constructional features of CNC machine and Retrofitting of Conventional Machine Tools.
3. **Apply** control system, feedback devices, sensors and tooling in manufacturing processes.
4. **Arrange** the different machining operations in a program by using various codes and languages.
5. **Determine** the cost of machining operation of CNC and monitoring the various features to enhance the life span of the machine.
6. **Create** Process product models with CAM tools and CNC machines

Text & References Books:

1. Automation, Production system and computer integrated manufacturing by M.P. Groover, PHI
2. CAD/CAM by P. N. Rao, P. N. Rao, Tata McGraw Hillpublication
3. CAD/CAM/CIM by Bhupendra Gupta, Dhanpat Rai publication
4. Computer control of machine tools by Koren Yoram, Tata McGraw Hill publication

560302: Maintenance Management

Category	Title	Code	Credit-4			Theory Paper
Departmental Core	Maintenance Management	560302	L	T	P	Max. marks: 70 Min. Marks: 28 Duration: 3 hrs
			3	1	--	

Course Objectives: To make the student to understand:

1. To learn the Maintenance Management, Maintenance Planning and Scheduling ,Computerized Maintenance Management Systems
2. To learn the Maintenance Organization Structure and Policies
3. To understand the Controlling Maintenance Costs , Life Cycle Cost Concepts
4. To learn the Optimizing Spare Parts Inventory Levels and Total Productive Maintenance Concepts.
5. To learn the overall configuration and Maintenance of Production Machines, Manufacturing System.

Syllabus

Unit-I Introduction, Requirements: - Maintenance Engg., Maintenance Management, Types of Maintenance. Break down, Preventive, Predictive. Routine, continuous Schedule. Maintenance contract, Contract Act, Repair. Activity. Operating Practices to reduce Maintenance. Issues, Problems, Selection of System, Renovation. Addition, Restoration & Control.

Unit-II Maintenance Organisation: - Function. Layout. Centralized and Decentralized Maintenance. Incentives. Human Factors, Maintenance of Plant, Pre-requisites, Programmes, Strategies, Policies.

Unit-III Work Measurement in Maintenance: - Work Authorization and Contract, Rating and Evaluation. Work simplification. Estimation of Repair and Maintenance cost. Cost control for efficient operation. Small Plant Maintenance Control.

Unit-IV Maintenance Store & Inventory Control: - Store Room Materials & Standard Spares. Spares Management. Introduction to computer in Maintenance. Automation Maintenance, Information by computers. Computerized Planning and scheduling. Total Productive Maintenance: Activities, Planned Maintenance, Autonomous Effects, Evaluation Organizations, Maintenance, Aims, Steps, Total Preventive Maintenance, Zero Break down.

Unit-V Maintenance of Production Machines: - Lath m/c, Drilling m/c, Milling m/c, Welding m/c, Shaper.

Course outcomes: After successful completion of this course students will be able to:

1. **State** Maintenance Key Performance Indicators
2. **Use** a preventive maintenance plan and monitor its implementation and review of technical reports**.**
3. **Select** highest quality of production and the continuation of the workflow.
4. **Implement** team based continuous Improvement in Maintenance
5. **Apply** knowledge about Managing Maintenance Spare Parts and Logistics
6. **Perform** maintenance orders issued by the in charge, implemented and completed in the promised time for him and to make sure the machine is clean after the maintenance process.

Text & References Books:

1. Bikash Bhadury. 'Total Productive Maintenance". Allied Publisher Ltd. New Delhi.
2. BC langlay. "Plant Maintenance". Prentice-Hall International. New Jersey.

3. JD Pattern. Jr. "Maintainability and Maintenance Management". Instrument society of America, third edition.
4. P Gopalakrishnan and AK Banerji, "Maintenance and Spare Parts Management". Prentice-Hall of India (P) Ltd. New Delhi.