560111: Computational Techniques

Category	Title	Code	Credit-3			Theory Paper
			L	T	P	
BS	**Computational Techniques**	560111/690111	3	-	-	Max.Marks-70 Min.Marks-28 Duration-3hrs.

Objective of Course

1. To know about the formulation of L.P.P. & its solution
2. To explore the Game theory
3. To describe Probability and random Process
4. To describe random sampling and hypothetical test
5. To perceive the Z-transform techniques

Syllabus

Unit- I:Concept of LPP, LPP formulation, Graphical method for solving LPP with two variables, Simplex method, Duality theory, Transportation and Assignment problems. Non Linear Programming Problems (NLPP): Introduction of NLPP, constraints and non constraint problems of maxima and minima, constraints in the form of equations, Dynamic Programming: Basic concepts, Bellman's optimality principle, dynamic programming approach in decision making problems, optimal subdivision problems.

Unit- II: Introduction, competitive games, finite and infinite games, two person zero sum game, pure and mixed strategies, saddle point, maximin and minimax principle, solution of a rectangular game in terms of mixed strategies, Graphical method of (2xm) and (nx2) games.

Unit- III: Theory of Probability: Concept of probability, Random variable, discrete probability distribution, Continuous probability distribution, Moment generating function, Probability density function, some special distribution, Random Variable: Concept of Random variable, one dimensional Random variable, two dimensional, distribution function, Joint probability distribution function, Marginal probability distribution, cumulative probability distribution.

Unit- IV: Testing of Hypothesis, Origin of the theory of sampling, chi-square (χ^2) distribution, the t-distribution, Fisher's Z-distribution, student-distribution, Analysis of variance one way classification, two-way classification.

Z-transform and their properties, inverse Z-transform, convolution theorem, solution of difference equations by Z-transform. Basic concept of Bessel's function, Hankel transform and their properties, Parseval's theorem.

Course Outcomes After completing this course, the students will be able to:

CO's	Description of CO's
CO1	Determine the solution of Linear and Non Linear Programming Problems

CO2	Evaluate the problems related to game theory.
CO3	Acquire the knowledge of Probability theory and Random Variable.
CO4	Analyze the test of hypothesis and Analysis of Variance.
CO5	Identify the concept of transform.

Recommended Books:

1. I. Griva, S. G. Nash and A. Sofer: Linear and Non Linear Optimization, Society for Industrial & Applied, U. S. Mathematics , 2012.
2. F. B. Hildebrand: Methods of Applied Mathematics , Prentaince Hall, 1992.
3. H. C. Saxena: Mathematical Statistics, S Chand, 1986.
4. H. K. Dass: Advance Engineering Mathematics, S. Chand, 2018.
5. P. R. Thie and G. E. Keough: An Introduction to Linear Programming & Game Theory, Wiley India Private limited, 2008

560112: Production Engineering- I

Category	Title	Code	Credit-3			Theory Paper
Departmental Core-DC	Production Engineering- I	560112	L	T	P	Max.Marks-70 Min.Marks-28 Duration-3hrs.
			3	-	--	

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
5. Welding Handbook, Seventh Edition, Vol-1, Welding Processes -Arc and Gas Welding and

560113/560118: Maintenance Management

Category	Title	Code	Credit-3			Theory Paper
Departmental Core(DC)	Maintenance Management	560113/560118	L	T	P	Max. marks: 70 Min. Marks: 28 Duration: 3 hrs
			3	-	--	

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.

560114/560119: Production and Operations Management

Category	Title	Code	Credit-3			Theory Paper
			L	T	P	
Departmental Elective -DE	Production and Operations Management	560114/560119	3	-	-	Max.Marks-70 Min.Marks-28 Duration-3hrs.

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.

560115: Flexible Manufacturing System

Category	Title	Code	Credit-3			Theory Paper
Departmental Elective (DE)	Flexible Manufacturing System	560115	L	T	P	Max. marks: 70 Min. Marks: 28 Duration: 3 hrs
			3	-	--	

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:

1. Mikell P. Groover, Automation, Production Systems and CIM. "PHI
2. Greenwood, "Implementation of FMS", MacMillan Edition.
3. Talavage J. "FMS in Practice, Applications, design and Simulation", Marcel Dekker Inc.

4. Ranky P.O. "Design and Operation of FMS", IPS Publications, UK.
5. Hartely J. "FMS at Work", IPS Publications
6. William W. Luggen., "FMS Cells and Systems", PHI.

560116: Ergonomics and Work Study

Category	Title	Code	Credit-3			Theory Paper
Departmental Elective (DE)	Ergonomics and Work Study	560116/690116	L	T	P	Max.Marks-70 Min.Marks-28 Duration-3hrs.
			3	-	-	

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

560117: Total Quality Management

Category	Title	Code	Credit-3			Theory Paper
Departmental Elective (DE)	Total Quality Management	560117/690117	L	T	P	Max. marks: 70 Min. Marks: 28 Duration: 3 hrs
			3	-	--	

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.
5. Kim Todd, "World-class Performance", McGraw Hill, London

560118: Product Design and Development

Category	Title	Code	Credit - 3			Theory Paper
Open Category (OC)	Product Design and Development	800111	L	T	P	Max.Marks-70 Min.Marks-28 Duration-3hrs.
			3	-	-	

Course Objective:

The goal of the course is to give an introduction to multidisciplinary aspects of product development and innovation. Students will familiarize themselves with basic methodology and tools that can be used in product development projects. Practical problems will be considered in cooperation with companies in order to simulate real product development situations.

Syllabus:-

Unit 1:- Introduction, Product Development Process and Product Planning, Product life cycle concept.

Unit 2:- Product Specification Development, Product Architecture, Conceptual Design, Industrial Design.

Unit 3:- Design for Manufacturing and Assembly, Design for Environment, Robust Design.

Unit 4:- Physical Prototypes and Models and Experimentation, Human factors in design.

Unit 5:- Product Development, Economics, Patents and Intellectual Properties.

Course Outcome: - After the completion of the course the student will be able to

CO1. **Analyze** the demands and needs of customers to conceptualize product.
CO2. **Describe** the different steps involved in the product design.
CO3. **Analyze** the shortcoming in the product development.
CO4. **Identify** the opportunities to develop the product.
CO5. **Utilize** the recourses available in efficient manner for maximum productivity.
CO6. **Forecast** the impact of product on the surrounding environment.

Text Books and References:-

1. Kevin Otto and Kristin Wood, “Product Design: Techniques in Reverse Engineering and New Product Development”, 1/e, 2004, Pearson Education, New Delhi
2. Karl T. Ulrich and Steven D. Eppinger, “Product Design and Development”, Tata McGrawHill Edition, New Delhi, 2003
3. David G. Ullman, “The Mechanical Design Process”, McGraw-Hill Inc., Singapore, 1992

560119: Computer Integrated Manufacturing

Category	Title	Code	Credit-3			Theory Paper
Open Category (OC)	Computer Integrated Manufacturing	800112	L	T	P	Max. marks: 70 Min. Marks: 28 Duration: 3 hrs
			3	-	--	

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 Hill publication
3. CAD/CAM/CIM by Bhupendra Gupta, Dhanpat Rai publication
4. Computer control of machine tools by Koren Yoram, Tata McGraw Hill publication
5. Manufacturing Engineering and Technology by Serope Kalpakjian, PHI publication.