

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS): ANANTAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING
M.Tech (QUALITY ENGINEERING AND MANAGEMENT)

I- SEMESTER:

<i>Subject Code</i>	SUBJECT	L	P	C
16D36101	Project Management	4	-	4
16D35102	Precision Engineering	4	-	4
16D36102	Statistical Quality Control	4	-	4
15D31110	Total Quality Management	4	-	4
	ELECTIVE-I	4	-	4
15D34210	Quality Concepts in Product Development			
16D36103	Probability and Statistical Methods			
16D36104	Dimensional Metrology & Inspection			
	ELECTIVE-II	4	-	4
16D36105	Technology Management			
16D36106	Data Analysis Techniques			
16D36107	Supply Chain Management			
16D36108	Quality Engineering Lab	0	4	2
<i>TOTAL</i>		24	4	26

II-

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PROJECT MANAGEMENT (16D36101)**UNIT I****STRATEGIC MANAGEMENT AND PROJECT SELECTION**

Project selection models, Project portfolio process, Analysis under uncertainty, Project organization, Matrix organization

UNIT II**PROJECT PLANNING**

Work Breakdown Structure, Systems integration, Interface coordination, Project life cycle, Conflict and negotiation.

UNIT III**PROJECT IMPLEMENTATION**

Estimating Project Budgets, Process of cost estimation, Scheduling: Network Techniques PERT and CPM, Risk analysis using simulation, CPM- crashing a project, Resource loading, leveling, and allocation.

UNIT IV**MONITORING AND INFORMATION SYSTEMS**

Information needs and the reporting process, computerized PMIS, Earned value analysis, Planning-Monitoring-Controlling cycle, Project control: types of control processes, design of control systems, control of change and scope.

UNIT V**PROJECT AUDITING**

Construction and use of audit report, Project audit life cycle, Essentials of audit and evaluation, Varieties of project termination, the termination process, The Final Report – A project history.

TEXT BOOKS:

1. R.Panneer selvam,P. Senthil Kumar, Project Management, PHI, 2010.
2. Arun Kanada, Project Management A life cycle approach, PHI, 2011.

REFERENCES:

1. Jack R. Meredith, and Samuel J. Mantel Jr., Project Management – A Managerial Approach, John Wiley and Sons, 2006.
2. Harold Kerzner, Project Management – A Systems Approach to Planning, Scheduling and Controlling, John Wiley and Sons, 2006.

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PRECISION ENGINEERING (16D35102)

(Common to Advanced Manufacturing Systems & Quality Engineering & Management)

UNIT I:

CONCEPTS OF ACCURACY: Introduction – Concept of Accuracy of Machine Tools – Spindle and Displacement Accuracies – Accuracy of numerical Control Systems – Errors due to Numerical Interpolation Displacement Measurement System and Velocity lags.

GEOMETRIC DIMENSIONING AND TOLERANCING: Tolerance Zone Conversions – Surfaces, Features, Features of Size, Datum Features – Datum Oddly Configured and Curved Surfaces as Datum Features, Equalizing Datum's – Datum Feature of Representation – Form controls, Orientation Controls – Logical Approach to Tolerancing.

UNIT II:

DATUM SYSTEMS: Design of freedom, Grouped Datum Systems – different types, two and three mutually perpendicular grouped datum planes; Grouped datum system with spigot and recess, pin and hole; Grouped Datum system with spigot and recess pair and tongue – slot pair – Computation of Transnational and rotational accuracy, Geometric analysis and application.

UNIT III:

TOLERANCE ANALYSIS: Process Capability, Mean, Variance, Skewness, Kurtosis, Process Capability Metrics, Cp, Cpk, Cost aspects, Feature Tolerances, Geometric Tolerances. Surface finish, Review of relationship between attainable tolerance grades and different machining process, Cumulative effect of tolerances sure fit law, normal law and truncated normal law.

UNIT IV:

TOLERANCE CHARTING TECHNIQUES: Operation Sequence for typical shaft type of components, Preparation of Process drawings for different operations, Tolerance worksheets and centrally analysis, Examples, Design features to facilitate machining; Datum Features – functional and manufacturing Components design – Machining Considerations, Redesign for manufactured, Examples.

UNIT V:

FOUNDAMENTALS OF NANOTECHNOLOGY: Systems of nanometer accuracies – Mechanism of metal Processing – Nano physical processing of atomic bit units. Nanotechnology and Electrochemical atomic bit processing.

MEASURING SYSTEMS PROCESSING: In processing or in-situ measurement of position of processing point-Post process and on-machine measurement of dimensional features and surface-mechanical and optical measuring systems.

REFERENCES:

1. Precision Engineering in Manufacturing/Murthy R.L./New Age International (P) limited, 1996.
2. Geometric Dimensioning and Tolerancing / James D. Meadows / Marcel Dekker inc. 1995.
3. Nano Technology / Norio Taniguchi / Oxford University Press, 1996.
4. Engineering Design – A systematic Approach / Matousek / Blackie & Son Ltd., London
5. Precision Engineering/VC Venkatesh& S Izman/TMH

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STATISTICAL QUALITY CONTROL (16D36102)**UNIT I****INTRODUCTION**

Quality Dimensions – Quality definitions – Inspection - Quality control – Quality Assurance – Quality planning - Quality costs – Economics of quality – Quality loss function

UNIT II**CONTROL CHARTS**

Chance and assignable causes of process variation, statistical basis of the control chart, control charts for variables- \bar{X} , R and S charts, attribute control charts - p, np, c and u-Construction and application.

UNIT III**SPECIAL CONTROL PROCEDURES**

Warning and modified control limits, control chart for individual measurements, multi-vari chart, \bar{X} - chart with a linear trend, chart for moving averages and ranges, cumulative-sum and exponentially weighted moving average control charts.

UNIT IV**STATISTICAL PROCESS CONTROL**

Process stability, process capability analysis using a Histogram or probability plots and control chart. Gauge capability studies, setting specification limits.

UNIT V**ACCEPTANCE SAMPLING**

The acceptance sampling fundamental, OC curve, sampling plans for attributes, simple, double, multiple and sequential, sampling plans for variables, MIL-STD-105D and MIL-STD-414E & IS2500 standards.

REFERENCES:

1. Douglas C Montgomery, Introduction to Statistical Quality Control, John Wiley, Seventh Edition, 2012.
2. Grant E.L. and Leavensworth, Statistical Quality Control, TMH, 2000.
3. IS 2500 Standard sampling plans

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TOTAL QUALITY MANAGEMENT (15D31110)**(Common to Advanced Manufacturing Systems & Quality Engineering & Management)****UNIT – I:**

INTRODUCTION: The concept of TQM, Quality and Business performance, attitude and involvement of top management, communication, culture and management systems. Management of Process Quality: Definition of quality, Quality Control, a brief history, Product Inspection vs, Process Control, Statistical Quality Control, Control Charts and Acceptance Sampling.

UNIT – II:

CUSTOMER FOCUS AND SATISFACTION: The importance of customer satisfaction and loyalty-Crating satisfied customers, Understanding the customer needs, Process Vs. Customer, internal customer conflict, quality focus, Customer Satisfaction, role of Marketing and Sales, Buyer – Supplier relationships. Bench Marketing: Evolution of Bench Marketing, meaning of Bench marketing, benefits of bench marketing, the bench marketing process, pitfalls of bench marketing.

UNIT – III:

ORGANIZING FOR TQM: The systems approach, Organizing for quality implementation, making the transition from a traditional to a TQM organizing, Quality Circles. Productivity, Quality and Reengineering: The leverage of Productivity and Quality, Management systems Vs. Technology, Measuring Productivity, Improving Productivity Re-engineering.

UNIT – IV:

THE COST OF QUALITY: Definition of the Cost of Quality, Quality Costs, Measuring Quality Costs, use of Quality Cost Information, Accounting Systems and Quality Management.

UNIT – V:

ISO9000: Universal Standards of Quality: ISO around the world, The ISO9000 ANSI/ASQCQ-90. Series Standards, benefits of ISO9000 certification, the third party audit, Documentation ISO9000 and services, the cost of certification implementing the system.

REFERENCES:

1. Total Quality Management / Joel E.Ross/Taylor and Franscis Limited
2. Total Quality Management/P.N.Mukherjee/PHI
3. Beyond TQM / Robert L.Flood
4. Statistical Quality Control / E.L. Grant / McGraw Hill.
5. Total Quality Management- A Practical Approach/H. Lal
6. Quality Management/KanishkaBedi/Oxford University Press/2011
7. Total Engineering Quality Management/Sunil Sharma/Macmillan

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QUALITY CONCEPTS IN PRODUCT DEVELOPMENT (15D34210)

(ELECTIVE-I)

(Common to Product Design & Quality Engineering & Management)

UNIT I DESIGN FUNDAMENTALS, METHODS AND MATERIAL SELECTION Morphology of Design – The Design Process – Computer Aided Engineering – Concurrent Engineering – Competition Bench Marking – Creativity – Theory of Problem solving (TRIZ) – Value Analysis - Design for Manufacture, Design for Assembly – Design for casting, Forging, Metal Forming, Machining and Welding

UNIT II DESIGN FOR QUALITY

Quality Function Deployment -House of Quality-Objectives and functions-Targets-Stakeholders-Measures and Matrices-Design of Experiments –design process-Identification of control factors, noise factors, and performance metrics - developing the experimental plan- experimental design –testing noise factors- Running the experiments –Conducting the analysis-Selecting and conforming factor-Set points-reflecting and repeating.

UNIT III FAILURE MODE EFFECT ANALYSIS AND DESIGN FOR SIX SIGMA

Basic methods: Refining geometry and layout, general process of product embodiment - Embodiment checklist-Advanced methods: systems modeling, mechanical embodiment principles-FMEA method- linking fault states to systems modeling - Basis of SIX SIGMA –Project selection for SIX SIGMA- SIX SIGMA problem solving- SIX SIGMA in service and small organizations - SIX SIGMA and lean production –Lean SIX SIGMA and services

UNIT IV DESIGN OF EXPERIMENTS

Importance of Experiments, Experimental Strategies, Basic principles of Design, Terminology, ANOVA, Steps in Experimentation, Sample size, Single Factor experiments - Completely Randomized design, Randomized Block design, Statistical Analysis, Multifactor experiments - Two and three factor full Factorial experiments, 2^k factorial Experiments, Confounding and Blocking designs, Fractional factorial design, Taguchi's approach - Steps in experimentation, Design using Orthogonal Arrays, Data Analysis, Robust Design- Control and Noise factors, S/N ratios

UNIT V STATISTICAL CONSIDERATION AND RELIABILITY

Frequency distributions and Histograms- Run charts –stem and leaf plots- Pareto diagrams-Cause and Effect diagrams-Box plots- Probability distribution-Statistical Process control–Scatter diagrams –Multivariable charts – Matrix plots and 3-D plots.-Reliability-Survival and Failure-Series and parallel systems-Mean time between failure-Weibull distribution

REFERENCES

1. Dieter, George E., "Engineering Design - A Materials and Processing Approach", McGraw Hill, International Editions, Singapore, 2000.
2. Product Design Techniques in Reverse Engineering and New Product Development, KEVIN OTTO & KRISTIN WOOD, Pearson Education (LPE), 2001.
3. Product Design And Development, KARL T. ULRICH, STEVEN D. EPPINGER, TATA McGRAW-HILL-3rd Edition, 2003.
4. The Management and control of Quality-6th edition-James R. Evens, William M Lindsay Pub:son south-western(www.swlearning.com)
5. Fundamentals of Quality control and improvement 2nd edition, AMITAVA MITRA, Pearson Education Asia, 2002.

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PROBABILITY AND STATISTICAL METHODS (16D36103)**(ELECTIVE-I)****OBJECTIVE:**

To introduce the basic concepts of one dimensional and two dimensional Random Variables. To provide information about Estimation theory, Correlation, Regression and Testing of hypothesis.

To enable the students to use the concepts of multivariate normal distribution and principle components analysis.

OUTCOMES:

The course aims at providing the basic concepts of Probability and Statistical techniques for solving mathematical problems which will be useful in solving Engineering problems.

UNIT I**ONE DIMENSIONAL RANDOM VARIABLES**

Random variables - Probability function – Moments – Moment generating functions and their properties – Binomial, Poisson, Geometric, Uniform, Exponential, Gamma and Normal distributions – Functions of a Random Variable.

UNIT II**TWO DIMENSIONAL RANDOM VARIABLES**

Joint distributions – Marginal and Conditional distributions – Functions of two dimensional random variables – Regression Curve – Correlation.

UNIT III ESTIMATION THEORY:

Unbiased Estimators – Method of Moments – Maximum Likelihood Estimation - Curve fitting by Principle of least squares – Regression Lines.

UNIT IV TESTING OF HYPOTHESES:

Sampling distributions - Type I and Type II errors - Tests based on Normal, t, Chi-Square and F distributions for testing of mean, variance and proportions – Tests for Independence of attributes and Goodness of fit.

UNIT V MULTIVARIATE ANALYSIS:

Random Vectors and Matrices - Mean vectors and Covariance matrices - Multivariate Normal density and its properties - Principal components: Population principal components – Principal components from standardized variables.

BOOKS:

1. Jay L. Devore, “Probability and statistics for Engineering and the Sciences”, Thomson and Duxbury, Singapore, 2002.
2. Richard Johnson. ”Miller & Freund’s Probability and Statistics for Engineer”, Prentice – Hall of India, Private Ltd., New Delhi, Seventh Edition, 2007.
3. Richard A. Johnson and Dean W. Wichern, “Applied Multivariate Statistical Analysis”, Pearson Education, Asia, Fifth Edition, 2002.

REFERENCES:

1. Gupta S.C. and Kapoor V.K.”Fundamentals of Mathematical Statistics”, Sultan and Sons, New Delhi, 2001.
2. Dallas E Johnson et al., “Applied multivariate methods for data analysis”, Thomson and Duxbury press, Singapore, 1998.

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DIMENSIONAL METROLOGY & INSPECTION (16D36104)

(ELECTIVE-I)

UNIT I

LINEAR MEASUREMENT AND ANGULAR MEASUREMENT

Accuracy, Precision, Readability, Sensitivity, Linear measuring instruments - vernier – micrometer- Gauge blocks- dial indicator-comparators – Angle standards – vernier bevel protractor-sine bar – autocollimator.

UNIT II

STANDARDS FOR LINEAR AND ANGULAR MEASUREMENTS

Shop floor standards and their calibration, light interference, Method of coincidence, Slip gauge calibration, Measurement errors, Limits, fits, Tolerance, Gauges, Gauge design.

UNIT III

MEASUREMENT APPLICATION

Measurement of screw threads and gears – Radius measurement – surface finish measurement - Measurement of straightness-flatness-parallelism – squareness-roundness – circularity

UNIT IV

MODERN CONCEPTS

Image processing and its application in Metrology, Co-ordinate measuring machine, Types of CMM, Probes used, Application, Non-contact CMM using Electro-optical sensors for dimensional metrology.

UNIT V

MEASUREMENT SYSTEMS

System configuration, basic characteristics of measuring devices, Displacement, force and torque measurement, standards, Calibration, Sensors, Basic principles and concepts of temperature, Pressure and flow measurement, Destructive testing – Nondestructive testing.

TEXT BOOK:

1. R.K.Jain ,Engineering metrology ,khanna publisher,2009.
2. M. Mahajan,Text book of Metrology, Dhanpat Rai & Co P Ltd ,2012

REFERENCES:

1. Galyer J.F. and Shotbolt C.R.”Metrology for Engineers” ELBS, 1992.
2. Hune, K.J.Engineering Metrology, Kalyani Publishers, India, 1980.
3. Robinson, S.L. and Miller R.K. Automated Inspection and Quality Assurance, Marcel Dekker Inc.1989.

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TECHNOLOGY MANAGEMENT (16D36105)

(ELECTIVE-II)

UNIT I INTRODUCTION

Technology management - Scope, components, and overview. Technology and environment, Technology and society, Technology Impact analysis, environmental, social, legal, political aspects, techniques for analysis - steps involved. Technology policy strategy: Science and technology Policy of India, implications to industry, The dynamics of technology change

UNIT II TECHNOLOGY FORECASTING

Need, methodology and methods - trend Analysis, Analogy, Delphi, Soft System Methodology, Mathematical Models, Simulation, and System Dynamics.

UNIT III TECHNOLOGY CHOICE AND EVALUATION

Issues in the development new high tech products, Methods of analyzing alternate technologies, Techno-economic feasibility studies, Need for multi-criteria considerations such as, social, environmental, and political, Analytic hierarchy method, Fuzzy multi-criteria decision making, and other methods.

UNIT IV TECHNOLOGY TRANSFER AND ACQUISITION

Import regulations, Implications of agreements like Uruguay Round and WTO, Bargaining process, Transfer option, MOU- Technology Adoption and Productivity - Adopting technology-human interactions, Organizational redesign and re-engineering, Technology productivity.

UNIT V TECHNOLOGY ABSORPTION AND INNOVATION

Present status in India, Need for new outlook, Absorption strategies for acquired technology, creating new/improved technologies, Innovations, Technology Measurement- Technology Audit, Risk and exposure, R&D portfolio management

REFERENCES:

1. Joseph M. Putti, Management – A Functional Approach, McGraw Hill, 1997
2. Kenneth C. Laudon , MIS: Organisation and Technology, Prentice Hall, 1995
3. James A.Senn, Information technology in Business, Prentice Hall, 1995
4. Ronald J. Jordan, Security analysis and Portfolio Management, Prentice Hall, 1995
5. Irvin M. Rubin, Organisational behavior an experimental approach, Prentice Hall, 1995
6. Gerard H. Gaynor, Handbook of Technology Management, McGraw-Hill Professional, 1996
7. Richard C. Dorf, Technology Management Handbook, CRC, 1999

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DATA ANALYSIS TECHNIQUES (16D36106)**(ELECTIVE-II)****UNIT I STATISTICAL DATA ANALYSIS**

Data and Statistics- Review of Basic Statistical Measures-Probability Distributions-Testing of Hypotheses-Non Parametric Tests.

UNIT II DATA ANALYSIS I

Introduction – Basic concepts – Uni-variate, Bi-variate and Multi-variate techniques – Types of multivariate techniques – Classification of multivariate techniques – Guidelines for multivariate analysis and interpretation – Approaches to multivariate model building.

UNIT III DATA ANALYSIS II

Simple and Multiple Linear Regression Analysis – Introduction – Basic concepts – Multiple linear regression model – Least square estimation – Inferences from the estimated regression function – Validation of the model. Factor Analysis: Definition – Objectives – Approaches to factor analysis – Methods of estimation – Factor rotation – Factor scores - Sum of variance explained – Interpretation of results .Canonical Correlation Analysis - Objectives – Canonical variates and canonical correlation – Interpretation of variates and correlations.

UNIT IV DATA ANALYSIS III

Multiple Discriminant Analysis - Basic concepts – Separation and classification of two populations - Evaluating classification functions – Validation of the model. Cluster Analysis – Definitions – Objectives – Similarity of measures – Hierarchical and Non – Hierarchical clustering methods – Interpretation and validation of the model.

UNIT V DATA ANALYSIS IV

Conjoint Analysis – Definitions – Basic concepts – Attributes – Preferences – Ranking of Preferences – Output of Conjoint measurements – Utility - Interpretation. Multi Dimensional Scaling – Definitions – Objectives – Basic concepts – Scaling techniques – Attribute and Non-Attributes based MDS Techniques – Interpretation and Validation of models. Advanced Techniques – Structural Equation modeling

REFERENCES

1. Joseph F Hair, Rolph E Anderson, Ronald L. Tatham & William C. Black, Multivariate Data Analysis, Pearson Education, New Delhi, 2010.
2. Richard A Johnson and Dean W. Wichern, Applied Multivariate Statistical Analysis, Prentice Hall, New Delhi, 2012.
3. David R Anderson, Dennis J Sweeney and Thomas A Williams, Statistics for Business and Economics, Thompson, Singapore, 2011.

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SUPPLY CHAIN MANAGEMENT (16D36107)**(ELECTIVE-II)****UNIT I INTRODUCTION TO SUPPLY CHAIN MANAGEMENT**

Supply chain stages and decision phases process view of a supply chain. Supply chain flows. Examples of supply chains. Competitive and supply chain strategies. Achieving strategic fit. Expanding strategic scope. Drivers of supply chain performance. Framework for structuring drivers - Obstacles to achieving fit. Case discussions.

UNIT II DESIGNING THE SUPPLY CHAIN NETWORK

Distribution Networking – Role, Design. Supply Chain Network (SCN) – Role, Factors, Framework for Design Decisions. Models for facility location and capacity allocation. Impact of uncertainty on SCN – discounted cash flow analysis, evaluating network design decisions using decision using decision trees.

UNIT III SOURCING, TRANSPORTATION AND PRICING

Role of sourcing, supplier – scoring and assessment, selection and contracts. Design collaboration. Role of transportation, Factors affecting transportation decisions. Modes of transportation and their performance characteristics. Designing transportation network. Trade-off in transportation design. Tailored transportation, Routing and scheduling in transportation. International transportation. Analytical problems. Role Revenue Management in the supply chain, Revenue management for: Multiple customer segments, perishable assets, seasonal demand, bulk and spot contracts.

UNIT IV COORDINATION AND TECHNOLOGY

Co-ordination in a supply chain: Bullwhip effect. Obstacles to coordination. Managerial levers to achieve co-ordination, Building strategic partnerships. The role of IT supply Chain, The Supply Chain IT framework, CRM, Internal SCM, SRM. The role of E-business in a supply chain, The E-business framework, E-business in practice. Case discussion.

UNIT V EMERGING CONCEPTS

3PL- 4PL- Global Logistics -Reverse Logistics; Reasons, Activities, Role. Ware house Management- RFID Systems; Components, applications, implementation. Lean supply Chains-Sustainable supply Chains

REFERENCES

1. Sunil Chopra, Peter Meindl and Kalra, Supply Chain Management, Strategy, Planning, and operation, Pearson Education, 2013.
2. Robert B Handfield, Ernest L Nichols, Jr., Supply Chain Redesign – Transforming Supply Chains into Integrated Value Systems , Pearson Education , 2002.
3. Jeremy F. Shapiro, Modeling the supply chain, Thomson Duxbury, 2006.
4. David Simchi Levi, Philip Kaminsky and Edith Simchi Levi, Designing and Managing the Supply Chain, Mc Graw Hill, 2009.

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QUALITY ENGINEERING LAB (16D36108)

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II - SEMESTER:

<i>Subject Code</i>	SUBJECT	L	P	C
16D36201	Quality Management Systems	4	-	4
16D36202	Reliability Engineering	4	-	4
16D36203	Lean Manufacturing and Six Sigma	4	-	4
16D36204	Quality by Design	4	-	4
	ELECTIVE-III	4	-	4
16D36205	Software Quality Management			
16D35203	Production and Operations Management			
16D36206	Industrial Safety and Hygiene			
	ELECTIVE-IV	4	-	4
15D32210	Reverse Engineering			
16D36207	Decision Support Systems			
16D36208	Optimization Techniques			
15D54201	Research Methodology (Audit Course)			
16D36209	Quality Assurance Lab	0	4	2
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QUALITY MANAGEMENT SYSTEMS (16D36201)

Objective: To impart knowledge on the concept of quality, tools for analyzing quality ,Statistical tools in quality acceptance sampling and life testing

UNIT-I

Introduction to the concept of quality - quality control - quality assurance - quality management - quality and total quality - small q and big Q - concept of total quality management - TQM axioms - major contributions of deeming, juran and cross by to quality management - enablers for total quality - strategic quality management

UNIT-II

Quality costs - analysis of quality costs - loss function - Taguchi methods - total quality tools - pare to chart - fishbone diagram – check sheet - histograms - scatter diagrams - run charts - flow diagram – Bench Marking-Overview of ISO 9000:2000 certification-Quality circles.

UNIT-III

Experimental design-Guidelines Overview of fact oral experiments, replication, General Idea on Process optimization- Process Robustness Studies, Quality function deployment, failure mode, effect and criticality analysis, continuous process improvement- The PDSA cycle- Kaizen.

UNIT-IV

Statistical tools in quality - making predictions using the normal, Poisson and binomial probability distributions - statistical process control - control charts for variables – X and R charts - process capability indices - control charts for attributes - P, np, c and u charts

UNIT-V

Module IV (12 hours) Acceptance sampling - lot by lot acceptance using single sampling by attributes - OC curve - average outgoing quality and the AOQL - double sampling - multiple and sequential sampling - ATI and AFI - introduction to life testing and reliability, MTBF, MTTR, system reliability-components in series and parallel

Refernces:

1. Bester Field, Dale H, Carol Boeterfeld-Muchna, Glen H, Boeterfeld Mery Boeterfeld-Scare, 2003,
2. Total Quality Management, 3rd edition, Pearson Education, New Delhi.
3. Juran J.M., Gryna I.M., "Quality Planning and Analysis", Tata McGraw Hill Publishing Company. 3. Montgomery, douglas C2001, Introduction to statical quality control, fourth edition, John Wiley&sons Inc, New Delhi
4. Gerals M Smith-2004, Statistical Process Control and Quality Improvement-5th edition ,Pearson Education, New Delhi
5. Grant, Statistical Quality Control, McGraw Hill

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RELIABILITY ENGINEERING (16D36201)

UNIT I RELIABILITY CONCEPTS

Reliability definition – Quality and Reliability– Reliability mathematics – Reliability functions – Hazard rate – Measures of Reliability – Design life –A priori and posteriori probabilities – Mortality of a component –Mortality curve – Useful life.

UNIT II LIFE DATA ANALYSIS

Data collection –Non Parametric methods: Ungrouped/Grouped, Complete/Censored data – Time to failure distributions: Exponential, Weibull – Probability plotting – Goodness of fit tests.

UNIT III RELIABILITY ASSESSMENT

Different configurations – Redundancy – k out of n system – Complex systems: RBD – Baye’s approach – Cut and tie sets – Fault Trees – Standby systems.

UNIT IV RELIABILITY MONITORING

Life testing methods: Failure terminated – Time terminated – Sequential Testing –Reliability growth monitoring – Reliability allocation – Software reliability-Human reliability.

UNIT V RELIABILITY IMPROVEMENT

Analysis of downtime – Repair time distribution – System repair time – Maintainability prediction – Measures of maintainability – Inspection decisions –System Availability.

REFERENCES:

1. Charles E. Ebeling, “An introduction to Reliability and Maintainability engineering”, TMH, 2000.
2. Roy Billing ton and Ronald N. Allan, “Reliability Evaluation of Engineering Systems”, Springer, 2007.

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LEAN MANUFACTURING AND SIX SIGMA (16D36203)			

UNIT I: INTRODUCTION TO LEAN MANUFACTURING AND SIX SIGMA

Introduction to Lean- Definition, Purpose, features of Lean ; top seven wastes, Need for Lean, Elements of Lean Manufacturing, Lean principles, the lean metric, Hidden time traps. Introduction to quality, Definition of six sigma, origin of six sigma, Six sigma concept, Critical success factors for six sigma.

UNIT II LEAN SIX SIGMA APPROACH

Evolution of lean six sigma, the synergy of Lean and six sigma, Definition of lean six sigma, the principles of lean six sigma, Scope for lean six sigma, Features of lean six sigma, The laws of lean six sigma, Benefits of lean six sigma, Introduction to DMAIC tools.

UNIT III INITIATION FOR LEAN SIX SIGMA

Top management commitment – Infrastructure and deployment planning, Process focus, organizational structures, Measures – Rewards and recognition, Infrastructure tools, structure of transforming event, Launch preparation.

UNIT IV PROJECT SELECTION FOR LEAN SIX SIGMA

Resource and project selection, Selection of Black belts, Selecting projects – Benefit/Effort graph, Process mapping, value stream mapping, Balanced score card for project identification, project suitable for lean six sigma.

UNIT V THE DMAIC PROCESS AND INSTITUTIONALIZING THE LSS

Predicting and improving team performance, Nine team roles, Team leadership, DMAIC process, Institutionalizing lean six sigma, Design for lean six sigma, Case study presentations.

REFERENCES:

1. Michael L. George, Lean Six Sigma, McGraw-Hill, 2002.
2. James P. Womack, Daniel T. Jones, Lean Thinking, Free press business, 2003.
3. Forrest W. Breyfogle III, Implementing Six Sigma: Smarter solutions Using Statistical Methods, 1999.

4. Ronald G.Askin and Jeffrey B.Goldberg, Design and Analysis of Lean Production Systems, John Wiley & Sons, 2003.
5. Rother M. and hook J., Learning to See: Value Stream Mapping to add value and Eliminate Muda, Lean Enterprise Institute, Brookline, MA.

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QUALITY BY DESIGN (16D36204)

UNIT I INTRODUCTION

Perception of quality, Taguchi's definition of quality – quality loss function, Planning of experiments, design principles, terminology, normal probability plot, Analysis of variance, Linear regression models.

UNIT II

FACTORIAL EXPERIMENTS

Design and analysis of single factor and multi-factor experiments, tests on means, EMS rules.

UNIT III SPECIAL DESIGNS

2^k Factorial designs, Fractional factorial designs, Nested designs, Blocking and Confounding.

UNIT IV ORTHOGONAL EXPERIMENTS

Selection of orthogonal arrays (OA's), OA designs, conduct of OA experiments, data collection and analysis of simple experiments, Modification of orthogonal arrays.

UNIT V ROBUST DESIGN

Variability due to noise factors, Product and process design, Principles of robust design, objective functions in robust design - S/N ratios, Inner and outer OA experiments, optimization using S/N ratios, fraction defective analysis, case studies.

REFERENCES:

1. Krishnaiah, K. and Shahabudeen, P. Applied Design of Experiments and Taguchi Methods, PHI learning private Ltd., 2012.
2. D.C.Montgomery, "Design and analysis of experiments", John Wiley, Eighth Edition, 2012.
3. Nicolo Belavendram, "Quality by design" Taguchi techniques for Industrial experimentation, Prentice Hall, 1999.

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SOFTWARE QUALITY MANAGEMENT (16D36205)

(ELECTIVE-III)

UNIT I SOFTWARE QUALITY

Definition of Software Quality, Quality Planning, Quality system – Quality Control Vs Quality Assurance – Product life cycle – Project life cycle models.

UNIT II SOFTWARE ENGINEERING ACTIVITIES

Estimation, Software requirements gathering, Analysis, Architecture, Design, development Testing and Maintenance.

UNIT III SUPPORTING ACTIVITIES

Metrics, Reviews –SCM – Software quality assurance and risk management.

UNIT IV SOFTWARE QUALITY MANAGEMENT TOOLS

Seven basic Quality tools – Checklist – Pareto diagram – Cause and effect diagram – Run chart – Histogram – Control chart – Scatter diagram – Poka Yoke – Statistical process control – Failure Mode and Effect Analysis – Quality Function deployment – Continuous improvement tools – Case study.

UNIT V

QUALITY ASSURANCE MODELS

Software Quality Standards, ISO 9000 series – CMM, CMMI – P-CMM – Case study.

TEXT BOOK

1. Software Engineering: A Practitioners Approach, 5th Edition Roger S. Pressman McGraw – Hill International Edition, 6th Edition, 2006.
2. Ramesh Gopalswamy, Managing global Projects ; Tata McGraw Hill, 2002.

REFERENCES

1. Norman E – Fenton and Share Lawrence P flieger, Software metrics , International Thomson Computer press , 1997.
2. Gordan Schulmeyer. G. and James .L. Mc Hanus , Total Quality management for software, International Thomson Computer press , USA , 1990.
3. Dunn Robert M., Software Quality: Concepts and Plans, Englewood clifts, Prentice Hall Inc., 1990.
4. Metrics and Models in Software Quality Engineering, Stephen, Stephen H. Kan, Pearson education, 2006, Low price edition.

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PRODUCTION AND OPERATIONS MANAGEMENT (16D35203)

(ELECTIVE-III)

(Common to Advanced Manufacturing Systems & Quality Engineering & Management)

UNIT - I

OPERATION MANAGEMENT: Definition – Objectives – Types of production systems – historical development of operations management – Current issues in operation management.

Product design – Requirements of good product design – product development – approaches – concepts in product development – standardization – simplification – Speed to market – Introduction to concurrent engineering.

UNIT – II

VALUE ENGINEERING: objective – types of values – function & cost – product life cycle- steps in value engineering – methodology in value engineers – FAST Diagram – Matrix Method.

Location – Facility location and layout – Factors considerations in Plant location- Comparative Study of rural and urban sites – Methods of selection plant layout – objective of good layout – Principles – Types of layout– line balancing.

UNIT - III

AGGREGATE PLANNING: definition – Different Strategies – Various models of Aggregate Planning –Transportation and graphical models.

Advance inventory control systems push systems – Material Requirement – Terminology – types of demands – inputs to MRP- techniques of MRP – Lot sizing methods – benefits and drawbacks of MRP – Manufacturing Resources Planning (MRP –II), Pull systems – Vs Push system – Just in time (JIT) philosophy Kanban System – Calculation of number of Kanbans Requirements for implementation JIT – JIT Production process – benefits of JIT.

UNIT - IV

SCHEDULING: Policies – Types of scheduling – Forward and Backward Scheduling – Gantt Charts – Flow shop Scheduling – n jobs and 2 machines, n jobs and 3 machines – job shop Scheduling – 2 jobs and n machines – Line of Balance.

UNIT – V

PROJECT MANAGEMENT: Programming Evaluation Review Techniques (PERT) – three times estimation– critical path – probability of completion of project – critical path method – crashing of simple nature.

REFERENCES:

1. Operations Management/ E.S. Buffs/ John Wiley & Sons / 2007
2. Operations Management Theory and Problems/ Joseph G. Monks / Macmillan / McGraw Hill / 3rd Edition.
3. Production Systems Management/ James I. Riggs / John Wiley & Sons.
4. Production and Operations Management/ Chary/ McGraw Hill/2004
5. Operations Management/ Richard Chase/ McGraw Hill/2006
6. Production and Operation Management / PannerSelvam / PHI.
7. Production and Operation Analysis/ Nahima/ McGraw Hill/2004

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INDUSTRIAL SAFETY AND HYGIENE (16D36206)**(ELECTIVE-III)****UNIT I OPERATIONAL SAFETY**

Hot metal operation, boiler, pressure vessels – heat treatment shop – gas furnace operation – electroplating – hot bending pipes – safety in welding and cutting, Cold – metal operation – safety in machine shop – cold bending and chamfering of pipes- metal cutting – shot blasting, grinding, painting – power press and other machines. Management of toxic gases and chemicals – industrial fires and prevention – road safety – highway and urban safety – safety of sewage disposal and cleaning – control of environmental pollution – managing emergencies in industries – planning security and risk assessments, on – site and off site. Control of major industrial hazards.

UNIT II SAFETY APPRAISA LAND ANALYSIS

Human side of safety – personal protective equipment – causes and cost of accidents. Accidents prevention program – specific hazard control strategies – HAZOP training and development of employees – first aid – fire fight devices – accident reporting, investigation. Measurement of safety performance, accident reporting and investigation – plant safety inspection, job safety analysis – safety permit procedures. Product safety – plant safety rules and procedures – safety sampling – safety inventory systems. Determining the cost effectiveness of safety measurement.

UNIT III OCCUPATIONAL HEALTH

Concept and spectrum of health functional units and activities of operational health service – occupational and related disease – levels of prevention of diseases – notifiable occupational diseases Toxicology Lead – Nickel, chromium and manganese toxicity – gas poisoning (such as CO, Ammonia Chlorise, So2, H2s.) their effects and prevention – effects of ultra violet radiation and infrared radiation on human system.

UNIT IV SAFETY AND HEALTH REGULATIONS

Safety and health standards – industrial hygiene – occupational diseases prevention welfare facilities. The object of factories act 1948 with special reference to safety provisions, model rules 123a, history of legislations related to safety – pressure vessel act – Indian boiler act – the environmental protection act – electricity act – explosive act.

UNIT V SAFETY MANAGEMENT

Evaluation of modern safety concepts – safety management functions – safety organization, safety department- safety committee, safety audit – performance measurements and motivation – employee participation in safety - safety and productivity.

TEXT BOOKS:

1. John. V. Grimaldi and Rollin. H Simonds, “Safety Managenent”, All India traveler Book seller, New Delhi – 1989.
2. Krishnan N.V, “Safety in Industry”, Jaico Publisher House, 1996.

REFERENCES:

1. Occupational Safety Manual BHEL.
2. Industrial Safety and the law by P.M.C Nair Publishers, Trivandrum.
3. Managing emergencies in industries, loss prevention of India Ltd., proceedings, 1999.
4. Safety security and Risk management by U.K singh & J.M Dewam,. A.P.H. publishing company, New Delhi, 1996.
5. Singh, U.K and Dewan, J.M., “Sagety, Security and Risk Management”, APH publishing company, New Delhi, 1996.
6. John V Grimaldi, Safety Management. AITB publishers, 2003.
7. Safety Manual. EDEL engineering Consultancy, 2000.

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REVERSE ENGINEERING (15D32210)
(ELECTIVE-IV)

(Common to Product Design & Quality Engineering & Management)

UNIT I

INTRODUCTION

Scope and tasks of RE - Domain analysis- process of duplicating

UNIT II

TOOLS FOR RE

Functionality- dimensional- developing technical data - digitizing techniques - construction of surface model - solid-part material- characteristics evaluation -software and application- prototyping - verification

UNIT III

CONCEPTS

History of Reverse Engineering – Preserving and preparation for the four stage process – Evaluation and Verification- Technical Data Generation, Data Verification, Project Implementation

UNIT IV

DATA MANAGEMENT

Data reverse engineering – Three data Reverse engineering strategies – Definition – organization data issues - Software application – Finding reusable software components – Recycling real-time embedded software – Design experiments to evaluate a Reverse Engineering tool – Rule based detection for reverse Engineering user interfaces – Reverse Engineering of assembly programs: A model based approach and its logical basics

UNIT V

INTEGRATION

Cognitive approach to program understated – Integrating formal and structured methods in reverse engineering – Integrating reverse engineering, reuse and specification tool environments to reverse engineering –coordinate measurement – feature capturing – surface and solid members

REFERENCES

1. Design Recovery for Maintenance and Reuse, T J Biggerstaff, IEEE Corpn. July 1991
2. White paper on RE, S. Rugaban, Technical Report, Georgia Instt. of Technology, 1994
3. Reverse Engineering, Katheryn, A. Ingle, McGraw-Hill, 1994
4. Data Reverse Engineering, Aiken, Peter, McGraw-Hill, 1996
5. Reverse Engineering, Linda Wills, Kluiver Academic Publishers, 1996
6. Co-ordinate Measurment and reverse engineering, Donald R. Honsa, ISBN 1555897, American Gear Manufacturers Association

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DECISION SUPPORT SYSTEMS (16D36207)**(ELECTIVE-IV)****UNIT I DECISION MAKING**

Managerial decision making, system modeling and support-preview of the modeling process-phases of decision making process.

UNIT II MODELING AND ANALYSIS

DSS components- Data warehousing, access, analysis, mining and visualization-modeling and analysis-DSS development.

UNIT III KNOWLEDGE MANAGEMENT

Group support systems- enterprise DSS- supply chain and DSS-knowledge management methods, technologies and tools.

UNIT IV INTELLIGENT SYSTEMS

Artificial intelligence and expert systems-concepts, structure, types-knowledge acquisition and validation, knowledge representation

UNIT V IMPLEMENTATION

Implementation, integration and impact of management support systems.

REFERENCES:

1. Efraim Turban and Jay E Aronson, Decision Support and Intelligent Systems, Pearson education Asia, Seventh edition, 2005.
2. Elain Rich and Kevin Knight, Artificial intelligence, TMH, 2006.

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OPTIMIZATION TECHNIQUES (16D36208)

(ELECTIVE – IV)

(Common to Advanced Manufacturing Systems & Quality Engineering & Management)

Course Objectives:

1. To introduce the advanced optimization techniques such as classical optimization techniques, numerical optimization techniques and genetic algorithms.
2. Learn the knowledge to formulate optimization problems

UNIT - I

Classical optimization techniques: Single variable optimization with and without constraints, multi – variable optimization without constraints, multi – variable optimization with constraints – method of Lagrange multipliers, Kuhn-Tucker conditions.

UNIT - II

Numerical methods for optimization: Nelder Mead’s Simplex search method, Gradient of a function, Steepest descent method, Newton’s method, types of penalty methods for handling constraints.

UNIT - III

Genetic algorithm (GA) : Differences and similarities between conventional and evolutionary algorithms, working principle, reproduction, crossover, mutation, termination criteria, different reproduction and crossover operators, GA for constrained optimization, draw backs of GA,

Multi-Objective GA: Pareto’s analysis, Non-dominated front, multi – objective GA, Non-dominated sorted GA, convergence criterion, applications of multi-objective problems

UNIT – IV

Genetic Programming (GP): Principles of genetic programming, terminal sets, functional sets, differences between GA & GP, random population generation, solving differential equations using GP.

UNIT V

Applications of Optimization in Design and Manufacturing systems: Some typical applications like optimization of path synthesis of a four-bar mechanism, minimization of weight of a cantilever beam and general optimization model of a machining process.

TEXT BOOKS:

1. Optimal design – Jasbir Arora, Mc Graw Hill (International) Publishers
2. Optimization for Engineering Design – Kalyanmoy Deb, PHI Publishers
3. Engineering Optimization – S.S.Rao, New Age Publishers

REFERENCES:

1. Genetic algorithms in Search, Optimization, and Machine learning – D.E.Goldberg, Addison-Wesley Publishers
2. Genetic Programming- Koza
3. Multi objective Genetic algorithms - Kalyanmoy Deb, PHI Publishers

Course Out comes:

1. Students at the end of the course learn advanced optimization techniques to show real-life problems
2. Students can able to formulate and solve various practical optimization problems in manufacturing and service organizations

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RESEARCH METHODOLOGY (AUDIT COURSE)(15D54201)

DSC

RESEARCH METHODOLOGY

(Audit Course For M.Tech. –II Semester Program from 2015 admitted batches onwards)

UNIT I

Meaning of Research – Objectives of Research – Types of Research – Research Approaches – Guidelines for Selecting and Defining a Research Problem – research Design – Concepts related to Research Design – Basic Principles of Experimental Design.

UNIT II

Sampling Design – steps in Sampling Design – Characteristics of a Good Sample Design – Random Sampling Design.

Measurement and Scaling Techniques-Errors in Measurement – Tests of Sound Measurement – Scaling and Scale Construction Techniques – Time Series Analysis – Interpolation and Extrapolation.

Data Collection Methods – Primary Data – Secondary data – Questionnaire Survey and Interviews.

UNIT III

Correlation and Regression Analysis – Method of Least Squares – Regression vs Correlation – Correlation vs Determination – Types of Correlations and Their Applications

UNIT IV

Statistical Inference: Tests of Hypothesis – Parametric vs Non-parametric Tests – Hypothesis Testing Procedure – Sampling Theory – Sampling Distribution – Chi-square Test – Analysis of variance and Co-variance – Multi-variate Analysis.

UNIT V

Report Writing and Professional Ethics: Interpretation of Data – Report Writing – Layout of a Research Paper – Techniques of Interpretation- Making Scientific Presentations in Conferences and Seminars – Professional Ethics in Research.

Text books:

1. Research Methodology: Methods and Techniques – C.R.Kothari, 2nd Edition, New Age International Publishers.
2. Research Methodology: A Step by Step Guide for Beginners- Ranjit Kumar, Sage Publications (Available as pdf on internet)
3. Research Methodology and Statistical Tools – P.Narayana Reddy and G.V.R.K.Acharyulu, 1st Edition, Excel Books, New Delhi.

References:

1. Scientists must Write - Robert Barrass (Available as pdf on internet)
2. Crafting Your Research Future – Charles X. Ling and Quiang Yang (Available as pdf on internet)

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QUALITY ASSURANCE LAB (16D36209)