

Department of Statistics
Cochin University of Science and Technology

M Tech in Engineering Statistics

Revised Syllabus with effect from 2013
Admissions

Objective

The objective of this programme is to teach statistical methods to engineers so as to equip them to apply the recent statistical tools in the industrial sector. There is wide scope for this course as students are trained in statistical methods like reliability engineering, experimental design, statistical process control and ISO 9000, operation research, forecasting, software quality and reliability, six sigma tools and SAS programming, which are essential to assess and improve the quality and productivity in industrial sector. This course is aimed at bridging the gap between theoretically trained statisticians and the professional engineers. The first two semesters are devoted to classroom teaching and laboratory experiments. In the third and fourth semesters, the candidates will be sent to undertake a project work in industries of their choice. Graduates of this course are well placed in industries, software/BPO companies and academic/research organizations.

Eligibility

B.Tech or equivalent degree or AMIE in any discipline or AMII with a first class (60%) from any recognised University or institution with valid GATE score.

Syllabus

M.Tech Engineering Statistics

Semester I

Course Code	Paper	Core/ Elective	Credits
STA:3101	Basic Statistics	C	4
STA:3102	Reliability and Life Testing	C	4
STA:3103	Practical I	C	2
STA:3104	Seminar and Viva	C	-
STA:3105	Simulation Modeling and Analysis	E	4
STA:3106	Statistical Methods for Quality Assurance	E	4
STA:3107	Total Quality Management	E	4
STA:3108	Operations Research	E	4
STA:3109	Management and Maintenance of Information Systems	E	4
STA:3110	Production Planning and Control	E	4
STA:3111	Manufacturing Processes and Measurements for Quality	E	4

Semester II

STA:3201	Industrial Experimental Design	C	4
STA:3202	Forecasting and Decision	C	4
STA:3203	Practical II	C	2
STA:3204	Seminar and Viva	C	-
STA:3205	Methods Engineering	E	4
STA:3206	Engineering Maintainability	E	4
STA:3207	E-Commerce	E	4
STA:3208	Software Quality Management	E	4
STA:3209	Multivariate Methods	E	4
STA:3210	Statistical Inference	E	4

Semester III

STA:3301	Project Progress Evaluation	C	18
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Semester IV

STA:3401	Project Dissertation Evaluation and Viva	C	18
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STA 3101: BASIC STATISTICS

1. Notion of Probability, Conditional Probability and Independence, Bayes' Theorem, Rules of Probability, Random Variables, Joint Distributions, Mathematical Expectation, Chebychev's inequality.
2. Discrete Distribution: Bernouli, Binomial, Geometric, Negative Binomial, Poisson, Hypergeometric, Multinomial Distributions, Continuous Distributions: Uniform, Exponential, Gamma, Normal, Weibull, Beta, Distribution of function of Random variables.
3. Sampling mean and variance, Sampling distributions based on normal, Estimation, Properties of point estimators, Confidence interval, Maximum likelihood and Bayes estimators, Prediction intervals.
4. Hypothesis testing, Single and multiple sample case, Chi-square tests, Goodness of fit test, non-parametric tests, Wilcoxon rank sum and sign rank tests, Kruskal-Wallis test, Friedman f test, Rank correlation coefficient.

Text Books

1. Scheaffer, R.L and McClave, J.T.: Statistics for Engineers, Du Burg Press Boston, 1982.

Suggested Readings:

1. Bethea, R.M and Rhineheart, R.R: Applied Engineering Statistics, Marcel Dekker, 1991.
 2. Chatfeld, C: Statistics for Technology, Chapman and Hall, 1976.
 3. Miller J.R., Freund J.E. and Johnson R : Probability and Statistics for Engineers, 8th Edition, Pearson, 2010.
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STA 3102: RELIABILITY AND LIFE TESTING

1. Definition of Reliability, Importance of Reliability, Pattern of failures, Factor of Safety and Reliability, Reliability Management, time dependent reliability of components and systems - Failure rate time curve, Reliability and hazard functions, Modeling of failure rates, Estimation of failure rates from empirical data, mean time before failure, Parallel and series Systems, (k, n) systems, Complex Systems, Reliability enhancement, Reliability allocation.
2. Strength based Reliability and Inference Theory – General expression for Reliability, Expression for probability of failure, Reliability when strength (S) and load (L) follow normal, Log-normal, Exponential and extreme value distribution. Distributions of S and L, Structural Reliability – one member – one Load case, single member – Several load case, Reliability analysis of parallel system.

3. Maintainability and Availability – Maintainability, Preventive maintenance, Imperfect maintenance, repair – Time distributions, Unprepared failures, Optimal replacement strategy, Spare parts requirements, availability – Availability analysis development of the model, Systems with a single component, Series and parallel systems, System safety analysis, Failure models and effects – analysis, Event - tree analysis, Failure tree analysis, Minimal cut-sets.
4. Reliability testing – Objectives of reliability test, Details of reliability tests, Analysis of failure time, Accelerated life testing, Sequential life testing, Statistical inference and parameter estimation, confidence intervals, plotting of reliability data.

Text Book:

1. Rao, S.S: Reliability Based Design, McGraw-Hill, 1992. Chapters 1, 6, 8, 10, 12, 13, 14.

Suggested Reading:

1. Lewis, E.F : Introduction to Reliability Engineering, John Wiley and Sons, Second Edition, 1995.
2. Tobias, P.A. and Trindade D.C.: Applied Reliability, Van Nostrand Reinhold, Third edition, 2011.
3. Villemeur, A: Reliability Availability, Maintainability and Safety Assessment Vol.2, John Wiley and Sons, 1992.
4. Pages, A and Gondran, M.: System Reliability, Springer Verlag, 1986.

STA 3103: PRACTICAL I

Practical I will be based on the following:

- A) Measurements and Calibration for quality
- B) Gauge capability studies
- C) General programming practice and spread sheets
- D) Softwares for quality control and reliability

STA 3105: SIMULATION MODELLING AND ANALYSIS

1. Simulation: Definition, areas of application, System: discrete and continuous Systems, Model of System, Steps in a simulation study. General principles of discrete event–Simulation, Event scheduling/time advance algorithms, World views, Simulation examples: single channel queues news paper selling problem, reliability problem, Lead-time demand.
2. Random number generation, Properties of random numbers, Techniques of generation of pseudo–random numbers, Test for random numbers, Random variate generation: Inverse transform technique, Convolution method, Acceptance–rejection technique. Queuing Models, Long run measures of performance, Steady state models M/G/1, M/M/1/N/∞, M/M/C/∞/∞, M/M/C/K/K.

3. Simulation of manufacturing and material handling systems, Modeling of manufacturing system, Material handling systems, Goals and performance measurement, Modeling of down times and failures, Trace driven models, Simulation languages: Promodel – Extend - Auto Mod – Taylor II - Witness Simul8– AIM – Arena.
4. Input modeling, Verification, Calibration and validation, Face validity, Validation of model assumption, Validating input-output. Analysis of simulation data: Output analysis for terminating simulations, Output analysis for steady state simulations.

Text Book:

1. Jerry Banks et.al. : Discrete – Event System Simulation, Fifth Edition, Prentice Hall, 2009.

Suggested Readings:

1. Law, A. M: Simulation Modeling and Analysis, Fourth edition, McGraw Hill New York, 2007.
2. Gordon, G : System Simulation, Second Edition, Prentice Hall, 1978
3. Fishman: Principles of Discrete Event Simulation, Wiley, New York, 1978.

STA 3106: STATISTICAL METHODS FOR QUALITY ASSURANCE

1. The concept of quality, need for quality assurances, Acceptance Sampling for attributes, Design and analyzing of single, double, multiple and sequential sampling plans, measurement of the performance of the sampling plans, AOQ, AOQ, AOQL, ASN and ATI.
2. Acceptance sampling by variables, Sampling plans with a simple specification limit with known and unknown variance, Sampling plan with double specification limits, Comparison of sampling plans by variables and attributes CSP-I, CSP-II and CSP-III.
3. Control charts, basic ideas, design and uses, Shewhart control chart for attributes and variables, modified control, process capability studies, control charts with memory, CUSUM charts, Six Sigma limits.
4. Total Quality Management, Strategies for T.Q.M., I S O 9000 standards, Establishing and monitoring quality systems, Application of I.S.O. 9000 to services, Quality costs, I.S.O. 9000 registration. Q.S.9000.

Text Book:

1. Mittag, H.J and Rinne, H.: Statistical Methods of Quality Assurances Chapman and Hall, 1990. Chapters 1, 3, 4.
2. Subburaj, R.: I.S.O 9000 path to T.Q.M., Allied Publication Ltd. (1997). Chapters 1 to 8, 10, 11.

Suggested Readings:

1. Oakland, J.S and Followel, R.F.: Statistical Process Control, East West Press, 1990.
 2. Chin-Knei Cho: Quality Programming, John Wiley, 1987.
 3. Juran, J.M and Gryana, F.M.: Juran's Quality Handbook: The Complete Guide to Performance Excellence 6/e, McGraw Hill, 2010.
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STA 3107: TOTAL QUALITY MANAGEMENT

1. Basics of Quality and Total Quality Management – Scope and objectives. Analysis of quality costs – Economic models – Quality improvement and cost reduction. Quality planning and sales income – Life cycle costs – Control of quality – Measuring Performance – Continuous process regulation. Strategic quality management – Quality policy – Training for quality – Organization for quality – Developing quality culture – Quality circles. TQM & JIT.
2. Designing for quality – Safety and manufacturability – Design review – Quality function development – Concurrent engineering – Software development – Manufacturing planning for quality – Automated manufacture – Inspection, test, and measurement.
3. Supplier relationship – Supplier selection – Statistical tool for supplier selection. Marketing, Field performance and customer service – Safety and product liability – Failure mode and effect analysis – Total productive maintenance, Benchmarking: Definitions – Reasons – Planning.
4. Management tools: Forced field analysis – Nominal group techniques – Affinity diagram – Interrelationship digraph – Tree diagram – Matrix diagram – Prioritization matrices – Process decision chart – Activity network diagram, Quality system: ISO 9000/QS 9000 – Basics, Six sigma for Quality, ISO 14000 Basics.

Text Book:

1. Juran, J.M and Gryna, F.M : Quality Planning and Analysis for Enterprise Quality, 5th Edition, McGraw Hill, 2007.
2. Besterfield, D.H et al: Total Quality Management, 3rd Edition, Pearson Education, 2003.

Suggested Readings:

1. Evans J.R and Lindsay W.M.: The Management and Control of Quality, Cengage Learning, 2008.
 2. Pyzdek, T.: Six sigma handbook ,3rd Edition, McGraw Hill, 2010
 3. Narayan, B.: Total Quality Management, A.P.H Publishing, New Delhi, 1998.
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STA 3108: OPERATIONS RESEARCH

1. Optimization, Functions of single and several unaccompanied variable, Search techniques, Mathematical programming models, Linear programming, Graphical solution, Simplex method (Without proof), Integer Programming.
2. Transportation model – Assignment model – Network models – Minimal spanning tree algorithm – Shortest route problem – Maximal flow model – Minimal capacitated flow problem – Decision analysis and games – Decision making under certainty(AHP) – Decision making under risk – Decision making under uncertainty.
3. Game theory – Markovian decision process – Scope of the Markovian decision problem – The Gardener problem – Finite state dynamic programming model – Infinite stage model – Linear programming solution – Review of Markov chains.
4. Application of operations research to machine requirement problem. Layout design, facility location. Linear programming approach to aggregate planning scheduling, Operations techniques for productivity improvement.

Text Books:

1. Millier, D.M and Schimidt J. W : Industrial Engineering and Operations Research, John Wiley and sons, 1990.
2. Taha, H.A : Operations Research, VIII Edition, Wiley, 2007.

Suggested Readings:

1. Cooke, W.P.: Quantitative Methods for Management Decisions, McGraw, Hill Book Company, 1985.
2. Hillier, F.S and Lieberman, G. J: Introduction to Operations Research, Ninth Edition, Mc Graw-Hill, 2012.
3. Hartely, R.V.: Operations Research: A Managerial Emphasis, Good Year Publishing Company.

STA 3109 MANAGEMENT AND MAINTENANCE OF INFORMATION SYSTEMS

1. Basic concept and terminology – categories of hardware and software — the meaning of a management information system - classification of management information systems – MIS and organizational levels – decision support systems.
2. Data and databases –meaning of database file - types of file organization - data models (relational, hierarchical, and network) -database design -data communications - information systems development – system analysis – system design.

3. Accounting information systems and packages -inputs to the financial management information system -financial MIS subsystems and outputs -manufacturing information systems and packages.
4. Maintenance of information systems -task areas and task fields – combining them to form processes – state model – extended state model – three kinds of MCM – tripple model of MCM-3. Quality and auditing – ISO standards – skills and working environments – outsourcing – third party maintenance – economic aspects – juridical concepts- contracts.

Text Books:

1. Schultheis, R.: Management information systems, New Delhi Tata McGraw Hill Education, 1998.
2. Looijen M.: Information Systems – Management Control & Maintenance, Kluwer Berdrijfs Informatic b.v., 1998.

Suggested Readings:

1. IT Infrastructure Library Modules, C.C.T.A., London, 1998.
2. Murdick, R.G.: Information systems for modern management, 3rd edition - New Delhi Prentice- Hall of India, 2003

STA 3110: PRODUCTION PLANNING AND CONTROL

1. Product development and research: Design function – Manufacture Vs purchase – Development of design – Experimentation – Proto-type production and testing simplification and standardization – Selection of materials and processes.
2. Aggregate planning – Planning strategies – Resource scheduling – Network scheduling, critical path method – PERT calculation. Production Planning: Importance of planning – Job, batch an mass production – Determination of economical lot size, functions of production - control; routing, scheduling, dispatching and follow up. Gantt chart.
3. System synthesis: Importance – Lot size for time varying demands, Wagner – Wittin algorithm. Material requirements planning, overview – Tools and terminology – Mechanics of MRP – Manufacturing resource planning. Just in time production Kanban.
4. Material and Inventory Management: Purchasing function and source development. Location and selection of suppliers – Vendor Rating – Rating – Inventory concepts – Inventory function – Cost of inventory holding and stock out – Service levels and safety stocks consideration for demand items – Classification of materials – ABC analysis, material handling and control – EOQ – Quantity discounts, Systems of stock replenishment – Fixed internal replenishment systems.

Text Book:

1. Riggs J. L.: Production Systems, Planning Analysis and Control, John Wiley, 1987.

Suggested Readings:

1. Dieter G. E.: Engineering Design, McGraw Hill, 2000.
 2. Roger G Schroeder: Operations Management, 3rd Edition, Tata McGraw Hill, 2009.
 3. Buffa: Modern Production/Operations Management 8th Ed, John Wiley, 1994.
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STA 3111: MANUFACTURING PROCESSES AND MEASUREMENTS FOR QUALITY

1. Classification of Manufacturing Processes: General introduction, Primary and secondary process. Process for changing shapes. (Preliminary concepts), Computer integrated manufacturing: Concepts in automation, definition of automation, levels of automation, high volume discrete parts production. Basic concepts in robotics: Resolution security and repeatability. Advantages and application of robots. Computer numerical control: Basic theory of numerical control, advantages of numerical control, open and closed system.
2. Introduction to quality assurance and statistical quality control – Inspection principles and practices: Inspection fundamentals – Sampling Vs 100% inspection – Automated inspection – Off-line and on-line inspection – Quantitative analysis of inspection – Coordinate measuring machines (CMM) – Flexible inspection systems.
3. Introduction to Metrology, Significance of measurements, calibration, precision, accuracy, sensitivity, readability, interchangeability and selective assembly – Standard of measurements, basic standard of length, mass, force, time, frequency and temperature, error in measurements, error classification. Limits, fits and tolerances – Standard system – Selection of fits, tolerance for linear dimension. Tolerance for screw threads, gear tolerances, ISI standard for tolerance – Limit gauging – Taylor's principle of gauging – Classification of gauges. Gauge tolerance and wear allowance.
4. Linear measuring instruments – Vernier calipers – Micrometers – Mechanical, optical, electronic, hydraulic and pneumatic comparators. Angular measuring instruments – Sine bar – Angle gauges – Spirit levels – Electronic level – Clinometers – Auto collimators. Radius measurements – Surface plated and rollers fixed roller instruments – Dynamic methods – V plate instruments – Co-ordinate method – Radial arm method – Circular division by mechanical indexing. Screw thread measurements – Terminology – Errors in thread – Measurements of external and internal thread elements – Screw thread gauges.

Text Books:

1. Kalpakjian, S. and Schmid, S.R.: Manufacturing Engineering and Technology, Fourth Ed, Pearson Education, Asia, 2000.
2. Jain, R.K.: Engineering Metrology, Khanna Publishers, 2002.

Suggested Readings:

1. Groover: Automation, Production system and Computer Aided Manufacturing, Prentice Hall, 2001.
 2. ASTM-Handbook of Industrial Metrology, Prentice Hall of India.
 3. Beckwith et al: Mechanical Measurement, Oxford and IBH Publishing, 1982.
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STA 3201: INDUSTRIAL EXPERIMENTAL DESIGN

1. Analysis of variance: General Linear Model, One-way analysis of variance, Two way analysis of variance, Interaction, Confidence intervals in one-way and two-way analysis of variance, Multiple treatment comparisons, Random ordering of the experimental sequence, CRD, RBD.
2. Factorial experiments: Simple and main effects, Factorial applied to randomized block designs, Taguchi experiments, Generalization of orthogonal arrays, Dealing with interactions, Confounding, Other designs.
3. Application of design of experiments, Product design, Managing the uncontrollable factors, Type of uncontrollable factors, Use of outer arrays for concurrent engineering, Application of design of experiments to reliability assurance.
4. Accelerated Life Testing, Environmental and operating stress, Interpreting data from accelerated tests, Developing an integrated reliability test program, Reliability improvements with design of experiments.

Text Books:

1. Condra, L.W : Reliability Improvements with Design of Experiments, Marcel Dekker, 1993.
2. Bethea, R.M and Rhineheart R : Applied Engineering Statistics, Marcel Dekker, 1991.

Suggested Readings:

1. Villemeur, A.: Reliability Availability, Maintainability and Safety Assessment Vol.2, John Wiley and Sons, 1992.
 2. Daniel, E.: Application of Statistics to Industrial Experimentation, John Wiley and Sons, 1976.
 3. Montgomery, D.C.: Design and Analysis of Experiments, John Wiley and Sons, New York, 2008.
 4. Lorenzen, T.J and Anderson, V.L : Design of Experiment, Marcel Bekker, 1993.
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STA 3202: FORECASTING AND DECISION

1. Need and uses of forecasting, Smoothing methods, Moving averages, Single and linear exponential smoothing, Decomposition of time series, trend fitting, Seasonal adjustments, Econometric models and forecasting.
2. Auto regressive moving average models, Adaptive filtering Box-Jenkins method. Forecasting systems for production planning and inventory management. Medium range and short term forecasting, forecast errors.
3. Decision making in production, aggregate planning problem - costs involved, planning horizon, Methods used in aggregate production planning.
4. Production planning, Scheduling and control in materials, Material Requirement Planning: approach to MRP – Procedure - Use of MRP, Manufacturing resource planning (MRP II)- Capacity Requirements Planning, Distribution Requirements Planning.

Text Book:

1. Silver, E.A and Peterson, R.: Decision systems for Inventory Management and Production planning, John Wiley and Sons, 1985.

Suggested Readings:

1. Miller, D.M and Schimidt, J.W : Industrial Engineering and Operations Research, John Wiley and Sons,1990.
 2. Makridakis, S and Wheelwright, S.S : Forecasting methods and Applications, John Wiley and Sons.
 3. Vollmann, T.E : Manufacturing Planning and Control for Supply Chain Management, 5th Edition, McGraw Hill, 2005
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STA 3203: PRACTICAL II

Practical II will be based on the following:

1. Work Measurements
 2. Spreadsheets for decision
 3. SPSS/SAS/R
 4. Design of Experiments.
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STA 3205: METHODS ENGINEERING

1. Role of work study in achieving economy in the manufacturing and service industries – Organization of work study department. Working conditions and the working environment, Work simplification: Objectives – Selection of jobs to be studied – Process charts – Operation analysis. Micromotion study – Principles of motion economy use of films. Cyclegraph and Chronocyclegraph techniques – Memomotion Study.
2. Work measurement: Objective – Techniques of work measurement – Time study, breakdown of work components – Concept of rating in time study – Basic times – Allowances – Standard time.
3. Synthesis of standard data – Estimation Techniques – Analytical estimation PTS, MTM, Work factor system etc. – Work sampling – Statistical techniques in work sampling study. Work study in office – Procedure for improving methods in office – Design and control of forms – Office layout.
4. Job evaluation and Merit rating – Objectives and principles of job evaluation – Merit rating – Merit rating plans. Wages and incentives – Primary wages system – Time rate and piece rate systems of payment – Incentives plans – Essentials of a good wage incentive plan.

Text Books:

1. Riggs, J. L : Production Systems, Planning analysis and control, John Wiley, 1987.
2. Introduction to Work Study, ILO Hand Book, UN, 1992.

Suggested Readings:

1. Mundel, M.E.: Motion and Time Study: Principles and Practice, Engelwood Cliffs, 1985.
 2. Niebel: Motion and Time Study, Irwin, 7th Edition.
 3. Barnes, R.M.: Design and Measurement of work, John Wiley, 1980.
 4. Meyers, Fred E : Motion and time study for lean manufacturing, Prentice hall, 2002
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STA 3206: ENGINEERING MAINTAINABILITY

1. Maintainability – Purpose and Importance – Terms and definitions – Maintainability Management – Product Life Cycle – Maintainability organizational structures – Program plan – Design reviews. Maintainability measures – Functions and models – System effectiveness – Availability and dependability models.
2. Maintainability tools – Failure Mode, Effects and criticality analysis – Cause and effect diagrams, TQM - Maintainability allocation. Maintainability Design considerations – Standardizations – Interchangeability – Modularization – Simplification – General maintainability design considerations.

3. Human factor consideration – Auditory and visual warning – Environmental factors – Safety considerations Electrical, Mechanical and other hazards – Safety checklists. Cost considerations – Costs associated with maintainability - Maintenance cost estimation models.
4. Reliability centered maintenance – The RCM Process – RCM implementation-review groups – Methods of monitoring equipment condition – RCM applications. Maintainability Testing, Demonstration and Data Maintenance models and Warranties.

Text Book:

1. Dhillon, B.S.: Engineering Maintainability, Prentice Hall of India, 2000.

Suggested Readings:

1. Kececioglu D.: Maintainability, Availability and Operational Readiness Engineering, Prentice Hall, New Jersey, 1995.
2. Elsayed E.A.: Reliability Engineering, Addison Western Massachusetts, 1996.
3. Moubray, J.: Reliability – Centered Maintenance, Industrial Press, Inc, New York, 1992.
4. AMCP 706-133: Engineering Design Handbook: Maintainability Engineering Theory and Practice, Department of Defense, Washington D C, 1976.

STA 3207 E-COMMERCE

1. Electronic Commerce Environment And Opportunities - Background, The Electronic Commerce Environment, Electronic Marketplace Technologies, Modes of Electronic Commerce – Overview , Electronic Data Interchange, Migration to open EDI, Electronic Commerce with WWW/Internet, Commerce Net Advocacy, Web Commerce.
2. Approaches to Safe Electronic Commerce – Overview, Secure Transport Protocols, Secure Transactions, secure Electronic Payment Protocol, Secure Electronic Transaction, Certificates for Authentication, security on Web Servers and Enterprise Networks. Electronics Cash and Electronic payment Schemes- Internet Monetary Payment and Security Requirements, Payments and Purchase Order Process, On-line Electronic Cash.
3. Internet/Intranet Security Issues and Solutions – The Need for Computer Security, Specific Intruder Approaches, Security Strategies, Security Tools, Encryption, Enterprise Networking and Access to the Internet, Antivirus Programs, Security Teams. MasterCard/Visa Secure Electronic Transaction – Introduction, Business Requirements, Concepts, Payment Processing.
4. E-Mail and secure E-mail Technologies for Electronic Commerce -Introduction, The Means of Distribution, A Model for Message Handling, How Does E-mail Work, MIME, S/MIME, MOSS, Comparisons of Security Methods, MIME and Related Facilities for EDI over the Internet References.

Text Book:

1. Minoli D. & Minoli E.: Web Commerce Technology Handbook, Tata McGraw-Hill, 1999.

Suggested Readings:

1. Kalakota, R. & Whinston A. B.: Frontiers of Electronics Commerce, Addison-Wesley, 1999.
2. Hughes L. J., Jr.: Internet Security Techniques, New Riders, 1995.
3. Bernstein et al: Internet Security for Business, John Wiley & Sons Inc, 1996.
4. Ahuja V.: Secure Commerce on the Internet, AP Professional (Academic Press), 1997.

STA 3208 SOFTWARE QUALITY MANAGEMENT

1. Framework for software quality – overview of SQA planning – establishing quality goals – quality assurance management – quality standards – six sigma – techniques and contents of a SQA plan.
2. Software testing – objectives of testing – functional and structural testing – testing strategies – unit testing – integration testing – system testing – test reporting – debugging – test automation.
3. Software reviews & audits – management review process – technical review process – software assertion process – walkthrough process – audit process – verification & validation.
4. Software reliability and availability – standards and evaluation of process – ISO 9000 – SEI Capability Maturity Model (CMM) – Software configuration management - Technical metrics for software.

Text Book:

1. Kenneth R S, Baker E. R.: Software Process Quality- Management and Control (1st Ed), CRC, 1999.

Suggested Readings:

1. Weinberg G.M. : Quality Software Management (Vol. 1-4), Dorset House, 1997
 2. Pressman R. S.: Software Engineering – A practitioners approach (7th Ed), McGraw Hill, 2009
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STA 3209: MULTIVARIATE METHODS

1. Multivariate normal distributions: Definition Mean vectors, Variance – Matrices, Correlations, Bivariate Normal Distributions, Multivariate outliers, Multivariate Summary Statistics, Assessing Multivariate Normality Covariance.

2. Principles Components Analysis: Objectives of Principal Components Analysis, Principal Components Analysis on the Variance – Covariance Matrix Σ Principal Component Scores, Component Loading Vectors, Estimation of Principal Components – Estimation of Principal Components Scores, Determining the Number of Principal Components – Method 1 & 2, PCA on the Correlation Matrix P – Principal Component Scores, Component Correlation Vectors, Sample correlation Matrix, Determining the Number of Principal Components, Testing for Independence on the Original Variables.
3. Factor Analysis: Objectives of factor Analysis, The factor Analysis Model, Factor Analysis Equations, Solving the Factor Analysis Equations, Choosing the Appropriate Number of Factors, Computer Solutions of the Factor Analysis Equations, Rotating Factors, Oblique Rotation Methods, Factor Scores.
4. Discriminant Analysis: Discrimination for Two Multivariate Normal Populations, Cost Functions and prior Probabilities (Two Populations), A General Discriminant Rule (Two populations), Discriminant Rules (More than Two populations), Variable Selection Procedures, Canonical Discriminant Functions, Nearest Neighbour Discriminant Analysis, Classifications Trees. Cluster Analysis: Measures of Similarity and Dissimilarity, Graphical aids in Clustering, Clustering Methods, Multidimensional Scaling.

Suggested Readings:

1. Johnson, D.E.: Applied Multivariate Methods for Data Analysis. Duxbury, USA, 1998.
2. Rencher, A.C.: Methods of Multivariate Analysis, John Wiley, New York, 1995.
3. Srivastava, M.S.: Methods of Multivariate Statistics, John Wiley, New York, 2002.

STA 3210: STATISTICAL INFERENCE

1. Estimation: formulation of the problem, properties of estimates, unbiased estimation, methods of estimation – Interval estimation.
2. Reliability estimation: The exponential, Gamma and Weibull models, estimation of reliability for these models with complete and censored samples.
3. Testing of hypothesis: Fundamental notions, Neyman – Pearson lemma, likelihood ratio tests, tests based on normality, non parametric procedures – Chi-square tests of goodness of fit, Kolmogrov – Smirnov Test, sign test, signed rank list, median test and tests for independence.
4. Regression analysis: Linear regression, least square estimation, generalized least squares, multiple regression, testing general linear hypothesis.

Suggested Readings:

1. Rohatgi, V.K.: An Introduction to Probability Theory and Mathematical Statistics, John Wiley and Sons, 1976.
2. Sinha, S.K.: Reliability and Life testing, Wiley Eastern, 1986.
3. Montgomery and Peck: Introduction to linear regression analysis, 4th Edition, Wiley Inter science, 2006.