PAKISTAN ENGINEERING COUNCIL

Curriculum for Engineering Practice Examination (EPE)
Textile Engineering

Total Marks: 100

MAIN OBJECTIVE:

The main objective of Engineering Practice Examination (EPE) is the assessment of competence, knowledge and skills of a Registered Engineer (RE), after having attained a minimum of five years of practical experience in relevant field of engineering from a recognized engineering organization, institution or allied service, and has earned requisite CPD (Continuing Professional Development) credit points.

PART-I (COMMON TO ALL DISCIPLINES)

This is common to all disciplines comprising of 30 questions of one mark each (total marks 30) with the duration of 2 hours, dealing with engineering related management, communication skills and ethics.

MANAGEMENT (ENGINEERING RELATED) 34%

i. Quality Issues: fundamental concepts, application and role

ii. Finance: cost analysis, financial discipline

iii. Procurement/Legal: bidding, contracts, arbitration, guarantees, liabilities

iv. Latest Trends: emerging technologies and their applications.

Suggested Books:

- PEC bidding/contract documents (www.pec.org.pk; www.picc.org.pk)
- FIDIC documents
- W.G. Sullivan, J.A. Bontandelli and E.M. Wicks, “Engineering Economy”, 11th Ed., Prentice Hall Inc., 1999
- Franklin and John Stermole, “Economic Evaluation and Investment Decision Methods” (9th Edition)
- Project Management Institute , A Guide to the Project Management Body of Knowledge (PMBOK® Guide) - Fourth Edition, Published by Project Management Institute, weblink: A Guide to the Project Management Body of Knowledge (PMBOK® Guide) - Fourth Edition, 2008.

2. WRITTEN COMMUNICATION SKILLS 33%

i. English Language Communication Skills

- Paragraph and essay writing
- Academic and presentation skills

ii. Technical Report Writing Skills

- Project/ research proposals
- Monitoring and evaluation
- Progress and financial reporting

iii. Knowledge Management and Leadership Skills

Suggested Books:

- Writing. Intermediate by Marie-Christine Boutin, Suzanne Brinand and Francoise Grellet. Oxford Supplementary Skills. Fourth Impression 1993. ISBN 0 19 435405 7 Pages 20-27 and 35-41
- Hargie, O. (ed.) Handbbook of Communications Skills, Routledge
- Writing. Advanced by Ron White. Oxford Supplementary Skills. Third Impression 1992, ISBN 0 19 435407 3
- Practical English Grammar by A.J. Thomson and A.V. Martinet. Exercises1, 3rd Ed., Oxford University Press, 1997. ISBN 0194313492
- Ellen, K. 2002. Maximize Your Presentation Skills: How to Speak, Look and Act on Your Way to the Top, Prima Lifestyles - 2005
- Oxford English Dictionary or equivalent, (Latest Edition)

3. ETHICAL AND SOCIAL ISSUES 33%

i. Code of ethics

ii. Professional obligation of engineers

iii. Role of opportunity and conflict

iv. Interpersonal relations, social stratification and culture

Suggested Books:

- PEC Code of Ethics (http://pec.org.pk/code_ethics.aspx)
- PEC Code of Conduct (http://pec.org.pk/code_conduct.aspx)
- Ethics in Engineering, Martin M. W., Martin M. and R. Schinzinger, McGraw-Hill, (Latest Edition)
- Ethics in Engineering Practice and Research, Whitbeck C., Cambridge University Press, (Latest Edition)
- Finchan, R., & Rhodes, P. (2003), Principles of Organizational Behavior, 3rd Ed., Oxford.
- Project Management Institute , A Guide to the Project Management Body of Knowledge (PMBOK® Guide) - Fourth Edition, Published by Project Management Institute, weblink: A Guide to the Project Management Body of Knowledge (PMBOK® Guide) - Fourth Edition, 2008.

PART-II (BREADTH)

This part assesses the breadth of Textile Engineering. The examination of this part is comprised of 30 multiple choices questions of one mark each (total 30 marks) and is of two (2) hour duration.

1. Mathematics for Engineers 10 %

i. Engineering Functions, Derivatives and their Application, Integration and its Application, Transcendental Functions, Multivariable Functions and Partial Derivatives, Infinite Series

ii. First, second, and higher Orders Differential Equations , Series Solution of Differential Equations, Special Functions, System of Differential Equations, Laplace Transforms

iii. Linear Algebra-Matrices, Vectors, Determinations, Linear System of Equations, Matrix Eigenvalue Problems, Fourier Analysis, Complex Numbers.

Suggested Books

- Calculus and Analytic Geometry by George B. Thomas and Ross L. Finney,
  2002
- Advanced Engineering Mathematics by Ervin Kreyszig, 2007

2. Statistics for Engineers 6%

i. Statistical Method

Fundamentals of Statistics, Types of variables, Measurement scales, Description of data tables and graphs, Stem and leaf plot, Box plot, dot diagram, Measures of central tendency, Measures of variability, Moments and Moment ratios, Coefficient of Kurtosis and Skewness, Chebyshev inequality and its application.

ii. Regression & Correlation

Introduction to regression and correlation, experimental and non-experimental data, scatter diagram, Estimation of parameters in simple linear regression by least squares method, Properties of least squares regression, prediction in SLR, Coefficient of determination, Multiple linear regression, Polynomial regression, Prediction in MLR, Simple, partial and multiple linear correlation coefficients and their properties.

iii. Probability and Distribution Theory

Introduction to probability and axioms of probability, Rules of counting, Basic laws of probability with proofs, Conditional probability, Discrete

and continuous random variables, Mathematical expectation and its properties, Marginal and conditional distributions, Discrete probability distributions; Uniform, Bernoulli, Binomial, Hypergeometric, Poisson, Continuous probability distributions; Normal, .

iv. Sampling & Sampling Distributions

Basic Definitions, Advantages of Sampling, Probability and Non-probability sampling, Sampling and non-sampling errors, Sampling distributions of sample mean, difference between means, proportion, difference between proportions, and variance with their properties, Concept of standard normal, student's t, χ^2 and F-distributions and their relations

v. Estimation & Hypothesis Testing

Introduction to statistical inference, Estimate, Estimators and their properties. Testing of hypothesis and interval estimation for population mean, difference between two population means, population proportion, difference between two population proportions, population and variance. Definition of P-value. Determination of sample size. Power of the test. Goodness of fit tests, test for independence in contingency table, test for equality of several proportions.

Suggested Books:

- "Introductory Statistics" by Wonnacott, T.H. and Wonnacott, RJ(1990). Jhon Wily & Sons. New York
- "Introduction to Statistics" by Walpole, R.E (2001) Macmillan Publishing Company
- "Probability and Statistics in Engineering" by William W. Hines, Douglas C. Montgomery and David M. Goldsman.
- "Introduction to Statistical Theory" by Chaudhrey, S.M and Kamal, S. (2002). Ilimi Kitab Khana, Urdu Bazar, Lahore
- "Polymer's Modern Statistics" by Rauf, M. (2001). Polymer Publications, Urdu Bazar, Lahore
- "Applied Statistics and Probability for Engineers" by Montgomery, Douglas C.
- "Introduction to Statistical Theory Part-II" by Prof. Sher Muhammad Chaudhary.

3. Physics 6 %

i. Classical Mechanics:

Physical quantities and Vectors, Newton's laws and their applications Work, kinetic energy and Work energy theorem, Gravitational potential energy, elastic potential energy, conservative forces, Rotational motion about a fixed axis, dynamics of systems of particles, momentum, moment of inertia, Equilibrium, stress, strain, elastic modulus, elasticity & plasticity,

ii. Waves and Oscillation:

Simple Harmonic Oscillations, Forced Oscillation and Damped oscillation, Longitudinal and transverse waves, The wave equation, The principle of superposition for waves, Standing waves, Sound, Interference, Doppler's effect

iii. Electricity and Magnetism:

Fundamental concepts, Coulomb's law, Gauss's law and applications, Electric Potential, Equipotential surfaces, Capacitance, dielectrics, Motion of charged particles in magnetic field, Ampere's law, faraday's law & applications, Maxwell's equations, eddy currents, electromagnetic induction

iv. AC fundamentals:

Fundamentals of AC, behavior of currents and voltage across resisters, inductors and capacitors, measurement of power

v. Electronics:

Semiconductors, diodes, transistors and their applications, Oscillators, transducers

vi. Optics:

Nature of light, reflection, refraction, total internal reflection, Dispersion, polarization, scattering, Huygens's principle, Interference in thin films, Michelson's interferometer, Fresnel and Fraunhofer Diffraction, Multiple slits, X-rays diffraction, holography

Suggested Books:

- "University Physics" by Young, Freedman 12th Edition
- "Physics" by Halliday, Resnic, Krane 4th Edition
- "Electronic Devices" by Floyd 8th Edition

4. Chemistry 10 %

i. Fundamentals of Chemical Equilibria and Chemical Kinetics
ii. Physical Properties of liquids, their measurement & applications
iii. Surface Chemistry
iv. Fundamentals Organic Chemistry and Aromatic Hydrocarbons
v. Fats, Oils, Acids, Bases, Oxidizing and Reducing Agents, Solutions and their properties
vi. Water and its properties

Suggested Books

- Physical Chemistry by Dr.G.Nabi
- Physical Chemistry by Dr.Ghulam Rasool Ch.
- Essentials of Physical Chemistry by B.S.Bhal
- A Textbook of Physical Chemistry by S.Glasstone
- A Textbook in Engineering Chemistry by S.S.Dara
- A Textbook of Inorganic Chemistry by Partington
- A Textbook of Inorganic Chemistry, by M.Z.Iqbal A.M. Qureshi

5. Computer for Engineers 6 %

i. Computer hardware, Input devices, Output devices, Operating systems
ii. Introduction to programming, Documentation and styles, Appropriate use of controlled structure, Data types and sub programs, Data abstraction and verification.
iii. Hands on experience of current available softwares being used in all sub sectors of textile industry e.g. Gerber Clothing Technology, CAD/CAM/ERP, MATLAB, LABVIEW.

Suggested Books

- Discovering Computers by Shelly, Casbman, Waggoner
- Introduction to Computers by Peter Norton 2004
- Absolute beginner's Guide to Computer Basics by Michael Miller, 2007
- How Computer Work by Rou White and Timothy Edward Donns, 2005
- Beginner's Programming for Dummies by Wallace Wang, 2006

- You can do it!: A Beginner's Introduction to Computer Programming by Francis
- Glassborow, 2004
- Learn to Program (Pragmatic Programrs) by Chris Pine, 2006
- How Computer Programming Works by Dan Appleman, 2000

6. Fiber Science 10%

i. Fundamentals and Fine structure of fiber
   - Nature of matter, Intermediate bonds, Nature of fibers, Methods of investigation of fiber structure, Crystalline and non-crystalline regions, fringed fibers structure, Fine structure of important natural and man-made textile fibers

ii. Moisture and textile fibers
   - Equilibrium absorption of water, heat of sorption, rate of absorption of moisture, Retention of water, Swelling, Theories of moisture sorption

iii. Electric properties
   - Dielectric properties, Electrical resistance, Static electricity

iv. Optical Properties
   - Refractive index and birefringence, Measurement of refractive indices, Absorption and Dichroism, Reflection and luster

v. Thermal Properties
   - Thermal parameters, thermal expansion and contraction, Structural changes in fibers on heating, Melting, Setting.

Suggested Books:

- W.E.Morton & J.W.S. Hearle "Physical properties of textile fibers", 1997.
- H.J.Wood "Physics of fibers",1955.
- Textile Institute "Fiber structure by Hearle and Peters" (1963).
- "Monograph on fiber structure" Textile progress Vol. 2, No.4, (1970)

7. Textile Raw Materials 14 %

i. Classifications of textile fibers

ii. Production, properties and applications of natural fibers

iii. Production, properties and applications of conventional man-made fibers

iv. Properties and applications of high performance fibers

Suggested Books:

- Hand Book of Textile Fibres (Vol. II Man-made Fibres) by Gordon Cook 1960.
- Man-mad Fibres by R.W Moncrieff, 1975
- Man-made Fibres and Processing by Kelvin W, 1994

8. Mechanics of Fibrous Structures 10%

i. Fundamentals of Mechanics of Materials

- Stresses and Deformations, Stress - Strain Diagrams of Ductile and Brittle Materials, Isotropic and An-isotropic Materials, Modulus of Elasticity, Modulus of Rigidity, Elastic and Plastic Behavior of Materials, Linear and Non-Linear Elasticity, Repeated Loading.

ii. Tensile Behavior of Textile Materials

iii. Plasticity of Textile Materials

iv. Modeling of Textile Materials

Translation of Mechanical Properties of Fibres into Yarn, and Yarn into Fabric.

v. Fabric Hand and Drape Evaluation

- Fabric stiffness, wrinkling, and crease resistance

vi. Compression of Textile Materials

- Study of Resilience, Friction between Single Fibres, Friction in Plied Yarns

Suggested Books:

- Ferdinand P Beer, E Russell Jhonston Jr., Jhon T Dewolf "Mechanics of Materials" (2004)
- Jinlian Hu "Structure and Mechanics of Woven Fabrics" (2004)

- AE Bogdanovich, C M Pastore “Mechanics of Textile and Laminated Composites” (1996)
- Textiles Research Journals
- Plastics (Materials and processing) by Brent Strong 2006
- Mechanical Behavior of Materials by Thormen H Courty 1990
- Mechanics of Materials by E.J Hearn, 1998
- Structure & Mechanics of Textile Assembiles by P Schwartz
- Structural Mechanics of Fibres Yarn and Fabric by JWS Hearle, 1969
- Physical Properties of Textile Fibres by WE Molton, 1997
- Mechanics for Textile Student by WA Hanton, 1960

9. Color Science 7%

i. Light and Color
   - Types and sources of light, electromagnetic spectrum.

ii. Human Eye
   - Structure of human eye, theories of color vision.

iii. Color Mixing and Matching
   - Additive color mixing, subtractive color mixing, chromatic effects, Visual color matching, color matching booths, Spectrophotometer, Kubelka-Munk theory of color matching, computer color matching, prediction and limitations.

v. Color Specification Systems and Measurement
   - Color order systems and their types, CIE Systems, computation of tri-stimulus values, visual and instrumental evaluation of whiteness and yellowness, whiteness and yellowness index, traditional whiteness formulae, Berger formula, hunter formula, application in textile industry

vii. Color Difference Measurements and Color Constancy
   - Color differences, Metamerism and its types, Instrumental color assessment, color difference equations and measurements, pass fail standards.

Suggested Books:

- Color Measurement (Principles, advances and industrial Applications), By: M. L. Gulrajani
- Color Physics for industry, By: roderck Mc Donald
- Color Vision and Technology, BY: Rolf G. Kuehni
- Textile Science, BY: E.P.G Gohl, and L.D. Vilensky

10. Textile Engineering Utilities 14%

i. Compressors, air conditioners, humidifiers
ii. Electrical motors, electronic control and automation systems, and Industrial lighting
iii. Steam generation and transportation systems
iv. Water and energy conservation in textile industry
v. Basic concepts of energy generation resources

Suggested Books:

- Air-conditioning in Textile Mills by S. P. Patel, ATIRA silver jubilee monographs, 1974
- Heat Transfer Design Methods by John J. McKetta Jr, 1991
- Textile Project Management by A. Ormerod, 1992.

11. Environmental Issues 7%

i. Textile & Environment
   - Air, water and noise pollution, effect of textile industry on environment

ii. Environmental Management Systems
   - ISO 14000, National Environmental Quality Standards

iii. Eco-labelling
   - Oeko-tex-100, EU eco-label

iv. Cleaner Production Technologies in Textile Industry
   - Reduction and control of pollution in textile industry, Environmental impact assessment an audits

v. Safety Concepts and Standards in Textile Industry

Suggested Books:

- G N Pandey, G C Carny (1989) Environmental Engineering, Tata McGraw Hills Co., New Dehli.
- P. Venugopala Rao (2004), Textbook of Environmental Engineering, PHI Learning Private Limited.
- Padma Vankar (2002) , Textiles effluent, NCUTE Publications, IIT, Delhi
- Eco friendly processing- NCUTE Publications.
- Environmental problems in chemical processing of textiles- NCUTE Publications.
  Waste water.
- An introduction to environmental pollution by Dr. B.K. Sharma.
  Environmental Impact of Textiles, BY: K Slater

PART-III (DEPTH)

This part assesses the depth of Textile Engineering. The examination of this part is comprised of 40 multiple choice questions and its duration is three (3) hours. Each candidate can attempt only one (1) opted area of practice from the following:

1. YARN MANUFACTURING

i. Classification of yarn manufacturing techniques
   - Short and long staple spinning systems
   - Filament yarn manufacturing systems

ii. Spinning Processes
   - Staple spinning processes
   - Modern staple spinning technologies

iii. Blow Room and Carding
   - Working principles of intermediate processes in blow room
   - Objectives of carding, carding actions, working of card, role of different parts and their speeds.

iv. Drawing
   - Concept of drafting, Real and perfect drafting, Draft calculation and system, Drafting and doubling, Objectives and working of drawing frame, Breaker, inter and finisher drawing frame.

v. Combing

- Objectives of combing, Combing preparatory processes, Study of comber.

vi. Roving

- Objectives of roving frame, Winding principles, Working of roving frame, Why and how twist is imparted in roving.

vii. Ring Spinning

- Objectives of ring spinning, Principle and mechanism of twist insertion, Working of ring frame

viii. Woolen Industry

- Wool and its classification, Impurities in wool, Wool scouring, carbonizing, drying and blending, Woolen and worsted yarn, woolen and worsted spinning processes, Woolen carding and woolen spinning.

ix. Worsted Industry

- Worsted carding, backwashing, gilling, combing, drawing and spinning.

x. Winding and Yarn Packing

- Objectives of winding, types of packages and windings, types of winders, splicing and
  yarn clearing.

Suggested Books:

- Manual of Cotton Spinning by Gilbert R. Merrill, 1960
- Spun Yarn Technology by Eric Oxtoby, 1987
- The Woolen & Worsted Industry by Brearley and Iredale, 1980
- W. Klein “Short Staple Spinning” (vol-I) (1998)
- Short Staple Yarn Manufacturing (1987) Dan J. McCreight, 1997

2. FABRIC MANUFACTURING

i. Warping and its objectives

- Yarn Packages, warping types, comparison of warping processes

ii. Sizing and its objectives
    - size types and recipes, detailed study of sizing machines
iii. Drawing-in and Knotting Techniques
iv. Basic Weaving Mechanisms
v. Conventional and Advanced Weft Insertion Methods
vi. Basic and Advanced Woven Fabric Structures and their Manufacturing Techniques
vii. Knitted Fabric Structures, Classification of Knitting Machines, Weft and Warp Knitting
viii. Properties and Usage of Weft and Warp Knitted Fabrics.

Suggested Books:

- Manual of Cotton Spinning by Gilbert R. Merrill, 1960
- Spun Yarn Technology by Eric Oxtoby, 1987
- The Woolen & Worsted Industry by Brearley and Iredale, 1980
- W. Klein “Short Staple Spinning” (vol-I) (1998)
- Short Staple Yarn Manufacturing (1987) Dan J. McCreight, 1997
- Sabit Adanur “Handbook of weaving” 2001
- Dr. M. Talukdar “Weaving, Mechanisms and Management” 1998
- Sara J.Kadolph “Textiles “10th edition, 2009
- N.Anumani “Knitting Fundamentals,Mchines,Structures and developments,1st edition, 2007.
- David J Spencer “Knitting Technology”3rd edition, 2001.

3. TEXTILE PROCESSING

i. Singeing and Shearing
    - Singeing and shearing, Shearing machine and its description, Singeing techniques (plate, roller, gas), Gas singeing positions, Gas singeing parameters, Gas singeing machine parts function, Singed fabric evaluation and testing , plate singeing process and parameters, roller singeing process and parameters.

ii. Desizing

- Sizing of cotton, types and chemical composition of sizing material, desizing techniques, advantages and disadvantages of desizing, effect of time, temperature, concentration, electrolytes and Ph on enzymes, acid and oxidative desizing techniques, testing and evaluation of desized fabric

iii. Scouring and Bleaching

- Scouring chemicals, auxiliaries and processes, scouring of natural and synthetic materials, standard testing and evaluation of scoured fabrics
- Principle and objectives of bleaching, bleaching chemicals, auxiliaries and techniques, chlorine and peroxide bleaching mechanism, advantages and disadvantages of chlorine and peroxide bleaches, exhaust and continuous bleaching principle, machine and methods, standard testing and evaluation of bleached fabrics.

iv. Mercerizing and Caustisizing

- Mercerizing and Caustisizing process and its objectives, effect of mercerization on cotton fiber, type of mercerizing methods (chain, chainless, slack and hot mercerizing), neutralization of mercerized fabrics, quality parameters of mercerizing process, testing and evaluation techniques of mercerized fabrics (barium activity number).

v. Cellulosic Dyeing

- Direct, reactive, vat and sulphur dyes, structure and classification, chemistry, theory, application, principle and methods, wash fastness improvement of direct dyes (diazotization, cationization, copper and formaldehyde after treatment), effect of electrolytes, alkalis, acids and bleaching agents on reactive dyeing, bronzing and tendering effect and method of sulphur dyeing, fastness properties of vat dyes and premature oxidation and its effect on dyeing.

vi. Disperse Dyeing

- Disperse dyes, structure and classification, chemistry and theory of dyeing, dyeing and fixing mechanism, temperature and pH effects, carrier dyeing method, limitations of carrier dyeing method, high temperature method of polyester dyeing, advantages of high temperature dyeing, high temperature method with carriers, thermosole dyeing method, testing and evaluation of disperse dyed fabrics.

vii. Dyeing of Wool, Silk and Acrylic

- Chemistry and theory of acid/basic dyeing, dyeing and fixation mechanism, wool, silk and acrylic dyeing using acid/basic dyes, temperature and pH effects on acid dyeing, role and chemistry of retarding agents, testing and evaluation of dyed fabrics.

viii. Design, Engraving and Printing

- Function/importance of design studio, methods involved in engraving, history of pigment printing, pigments and pigments properties, difference between dyes & pigments, application of pigments on cotton, role and brief chemistry of auxiliaries/binders used during pigment printing, advantages and disadvantages of pigment printing
- Reactive printing of cotton fibers, dye selection criteria , fixing mechanism, print paste formulation for reactive printing, print paste formulation for pigment printing.

ix. Finishing

- Sanforizing, emerizing, calendaring, raising.
- Water, soil and oil repellency, flame retardancy/resistency, anti-static finishing, antimicrobial finishing.

Suggested Books:

- Chemistry & Technology of Fabric Preparation & Finishing, Dr. Charles Tomasino, Department of textile engineering, chemistry and science college of textiles, North Carolina state university

- Color Vision and Technology, By AATCC
- Textile Science, E.P.G. Gohl and L.D. Vilensky, Second Edition, CBS Publishers & Distributors
- Textile Printing, W. C. Miles, Revised second edition, Society of dyers and colorists
- Finishing by Pietro Bellini, Ferruccio Bonetti, Ester Franzetti, Giuseppe Rosace and Sergio Vago, none, Fondazione Acimit, third edition, Fondazione Acimit

4. GARMENT MANUFACTURING

i. Apparel Design and Development Concept
   - Design Elements, Design Principles, Pre-adoption Phase, Line-adoption Phase, Post adoption Phase, garment sample types, garment sample development

ii. Pattern Making, Marker Making and Cutting
   - Concepts and pattern making, dimensions of marker, marker efficiency and quality, fabric spreading and cutting, manual and mechanized cutting types

iii. Stitches and Seams
   - Stitch formation (L/S, C/S, O/L, F/L), seam types and application areas

iv. Sewing Threads
   - Types, manufacturing, properties and applications

v. Sewing Machine Fundamentals
   - Sewing needles, bobbins, cases and hooks, looper, spreader, throat plates, tongues, chaining devices, lubricating systems and casting of main body

vi. Material Handling Systems
   - Progressive Bundle System (PBS), Unit Production System (UPS), Modular Production System (MPS)

vii. Technology Advancement

- Manually operated General – Purpose Machine, Semiautomatic Machine, Automatic Machine, Mechanization, Automation, Robotics

viii. Apparel Accessories & Work Aids

- Apparel Support Materials: Interlinings, Linings, Other Support Materials (Adhesives, Collar Stays, Shoulder Pads, etc)
- Trims: Embroidery, Applique, Laces, Knit Trims, Screen Prints, Heat Transfer, Prints, Labels
- Closures: Types of Closures, Zipper, Parts of a Zipper, Button & Buttonhole, Button Sizes
- Work Aids/Attachments: purpose, common types of attachments

ix. Garment Finishing & Packing

- Garment finishing, special treatments, stain removing, garment wet processing, seam quality defects
- Purpose, elements of pressing, types of pressing, pressing operations, pressing techniques, pressing equipments
- Different types of packing materials, packing styles, types of containers.

x. Quality Control in Apparel

- Process flow of Quality Department, Quality Control & Quality Assurance, How to Control Quality, DHU-Defects per Hundred Units, AQL-Acceptable Quality Level, Quality Zones in Garments

Suggested Books:

1. Apparel Manufacturing, Ruth E. Glock , Grace I. Kunz, Prentice Hall, 2000
2. Clothing technology, Eberle, H. (Ed.), Verlag Europa- Lehrmittel 2002
3. Applied knowledge of Sewing, Juki Corporation (Pub.)
4. Fashion from concept to consumer, Frings, Gini Stephens Prentice Hall, 1999