Nepal Engineering Council Registration Examination

TEXTILE ENGINEERING SYLLABUS (ATxE)

Chapters 1-4 are fundamentals/principles of concepts in textile engineering; chapters 5-9 are related to application of engineering principles in practice; and the last (10th) chapter is related to project planning, design and implementation.

1. Introduction to Textile Engineering and Textile Fibers (ATxE01)

1.1 Overview of Textile Engineering, Classification of textile fibers according to their nature and origin. Essential and desirable properties of textile fibers and their role in final products. (ATxE0101)

1.2 Advantages and disadvantages of natural and manmade fibers (cotton, silk, wool, jute, hemp, flex, polyamide, rayon, polyester, acrylics. (ATxE0102)

1.3 General principles of the manufacturing processes (wet, dry and melt spinning) of important man-made fibers (polyamide, rayon, polyester, acrylics), some technical specialty fibers like spandex/lycra etc. and their properties. (ATxE0103)

1.4 Action of chemicals on Textile fibers - Effect of alkalis, acids, oxidizing agents and reducing agents on cotton and viscose, wool, silk and the above synthetic FIBREs. Physical and chemical methods of fiber and blend identification and blend analysis. (ATxE0104)

1.5 Introduction of various fiber quality such as Length, fineness, strength, elongation, moisture regain / content etc. its importance, and measurements. (ATxE0105)

1.6 Methods of investigating fiber structure such as density, x-ray diffraction, birefringence, optical and electron microscopy such as SEM and TEM, I.R. spectroscopy, thermal methods such as DSC, DMA, TMA and TGA; Structure and morphology of fibers. (ATxE0106)

2. YARN SPINNING I (ATxE02)

2.1. Introduction and objectives of various preparatory processes involved in the production of yarn viz. Mixing and Blending: opening and cleaning (blow room and card), drawing (draw frame), combing (comber) and rove formation (speed frame). (ATxE0201)

2.2 Mixing, opening and cleaning: Bin mixing and mixing by automatic blenders, construction and working of machines of single process blow-room line. Different types of conventional feeders, openers and cleaners. Use of air currents for cleaning and transportation, blow room sequences for different natural and man-made fibers. (ATxE0202)

2.3 Carding: working Principles and objectives of conventional revolving flat card. Settings of various parts of the card and their effect on sliver quality. Various Types of card clothing, Flexible and metallic card clothing. (ATxE0203)

2.4 Drawing: Objects of doubling and drafting. working of conventional draw frame. Roller weighting and setting. Stop motions, sliver irregularity, drafting wave, roller slip, etc. (ATxE0204)

2.5 Combing: Objects, construction and working of conventional sliver lap and ribbon lap and comber machines. (ATxE0205)

2.6 Speed frames: Objects, construction and working of conventional fly frames, twisting, winding and building mechanisms. Speed and settings to suit different fibers. Stop motions. (ATxE0206)

3. Yarn SPINNING II (ATxE03)

3.1. Introduction and objectives of different spinning processes involved in the production of yarn viz. conventional (ring spinning) and unconventional (rotor, air-jet and friction spinning etc.) Spinning: Construction and working of conventional ring frame. Ring and traveller assembly. Spindles, building motions, etc. Specification of ring frame to suit different counts. (ATxE0301)

3.2. Properties and end uses of different types of yarns such as ring spun, rotor spun, friction spun and air-jet spun etc. (ATxE0302)

3.3. Principles of drafting, twisting and cop building in ring spinning; Causes of end breakages; Modern developments in ring spinning machine. (ATxE0303)

3.4. Introduction and short description of sewing thread and fancy yarns: ply cable yarn; core spun yarn, slub yarn, griddle, mélange yarns etc. Working principles of ring doubler and two-for-one twister; Relationship between single yarn twist and folded yarn twist. (ATxE0304)

3.5. Yarn numbering systems and calculations pertaining to conversions. Introduction of various yarn quality and its importance, Measurement of twist and linear density of yarn. Evenness testing of slivers, roving and yarns. (ATxE0305)

3.6. Influence of fiber geometry, fiber configuration and fiber orientation in yarn; Fiber packing density of yarn; Yarn diameter; relationship of yarn number and twist factor, Yarn twist and its relation to yarn strength; Helical arrangement of fibers in yarns; Yarn contraction; Fiber migration in yarns; Stress-strain relation in yarn; Mass irregularity of yarn; Structure-property relationship in ring, compact, rotor, air-jet and friction spun yarns. Various technical calculations related to yarn spinning, mechanical draft, actual draft, cleaning efficiency, twist multiplier, twist per inch, count etc**.** (ATxE0306)

4. Fabric Forming I (ATxE04)

4.1. Principles of compact, rotor, air-jet, air-vortex, friction, core, wrap and twist-less spinning processes. Introduction of various yarn quality and its importance, such as evenness, strength, hairiness, neps, thick and thin places, elongation. (ATxE0401)

4.2. Introduction and objectives of weaving preparatory process: Principles of winding processes; Classification of winding methods; Patterning mechanism; Yarn clearers and tensioners; Different systems of yarn splicing. (ATxE0402)

4.3. Introduction and objectives of Pirn winding. Principles of Beam and sectional warping processes and mechanisms. And calculation related to warping. (ATxE0403)

4.4. Introduction and objectives of sizing process. Types of Sizing machines. Sizing ingredients, size recipes for different materials. Control of size pick-up. Slasher speed and drying efficiency. Sizing waste and stretch control. Objectives of drawing in, twisting and knotting in weaving preparatory. (ATxE0404)

4.5 Classification of loom mechanism. such as primary, secondary and auxiliary motions. Various ways of shedding and kinds of sheds. Various methods of picking. under, over and crankshaft picking.

Their merits and demerits. Beating-up. Eccentricity of the slay and its effect on loom working. (ATxE0405)

4.6 Take-up and lef-off motions in conventional and shuttle less looms and its effect on fabric quality. Side weft fork motion. Loose reed and fast-reed warp protecting motions, various warp breaks stop motion. Timing and setting of various motions. Mechanisms of different types of negative and positive dobbies including cross-border, paper and cam types. Multiple box motions. Pick-at will motions. Calculations pertaining to the above machines and products dealt within the process. (ATxE0406)

5. FABRIC FORMING II (ATxE05)

5.1. Elements of fabric geometry: Cloth setting theories. Pierces equations and later modifications. relation of fabric properties to simple geometry, crimp interchange in woven fabrics, warp, weft and fabric cover factor, weight factor, etc. (ATxE0501)

5.2 Fabric classification and weave notation. Plain weave, its variations and ornamentation. Ordinary and steep twills. Twill derivatives pointed, broken, combination, diamond. Twills, herring-bone and twill checks. Satin weaves and satin derivatives. Its draft and peg plan. (ATxE0502)

5.3. A brief description about various parts of Jacquard, types of jacquards. Computer-aided design and its use in manufacture of various weave structures. Calculation based on Jacquard weaving. Relation between no. of hooks, ends per inch, repeat size, picks per inch etc. (ATxE0503)

5.4 Principles of weft insertion systems of shuttle-less weaving machines such as projectile, rapier, water-jet and air-jet; Principles of functioning of multiphase and circular looms; Types of selvedges, close selvedge, Tuck –in selvedge, Leno selvedge. (ATxE0504)

5.5. Constructions methods of Basic woven fabric and their derivatives; Crepe, cord, terry, gauze, leno and double cloth, terry cloth and their Drawing/ Drafting and lifting plans. (ATxE0505)

5.6 Production planning and machinery balancing. To acquaint with production rates, waste and efficiency levels of good and progressive textile mills. To determine the number of machines required to produce desired quantities of end products (yarns and fabrics) taking into consideration the production rate of machines in different departments, efficiency, losses and waste levels and important processing parameters like hank, draft twist multiplier, counts, settings, etc. used at different stages of manufacturing. (ATxE0506)

6. Knitting, Non-woven and industrial fabrics (ATxE06)

6.1. Fundamentals of weft knitting; Classification of weft knitting technologies; Weft knitted constructions such as plain, rib, interlock and purl; Different knit stitches such as loop, tuck and float. Characteristics of weft knitted fabrics. (ATxE0601)

6.2 Principle of warp knitting; Classification of warp knitting technologies; Swinging and shogging motion of guide bar; Basic warp knit construction such as pillar, tricot, atlas, inlay and nets. Characteristics of warp knitted fabric. (ATxE0602)

6.3. Fiber preparation processes for nonwovens; Web formation and bonding processes; Spun-bonding and melt-blowing technologies; Applications of nonwoven fabrics. (ATxE0603)

6.4 Textile Testing Sampling techniques for fibers, yarns and fabrics; Sample size and sampling errors. Moisture in textiles; Fiber length, fineness, crimp, maturity and trash content; Tensile testing of fibers; High volume fiber testing. Linear density of sliver, roving and yarn; Twist and hairiness of yarn; Tensile testing of yarns; Evenness testing; Fault measurement and analysis of yarns. Fabric thickness, compressibility, stiffness, shear, drape, crease recovery, tear strength, bursting strength, pilling and abrasion resistance; Tensile testing of fabrics; Objective evaluation of low stress mechanical. (ATxE0604)

6.5. Apparel introduction, demands and the raw materials required for manufacturing of garments, scope and potentials for setting up of apparel industries. Requirements of manpower, machines, materials, etc. and their testing. Minor fabric construction net, lace, bonded, etc. Pattern making and dress designing. Pattern making theory. (ATxE0605)

6.6 Principles of basic drafts, etc. Introduction to fullness in pattern making and its importance, etc. Different types of seams for different samples, etc. Drafting bodies at different age levels, etc., draping. Introduction of various machines and equipment used in garment manufacturing and different types of cutting machines, etc. Different types of sewing machines. different types of stitches. Washing, Dyeing, printing and finishing of garments. Garment defects and their remedies. (ATxE0606)

7. Chemical Processing / wet processing I (ATxE07)

7.1. Chemistry and practice of preparatory processes for cotton; Preparatory processing of wool and silk; Mercerization of cotton; (ATxE0701)

7.2. Chemistry and practice of Preparatory processes for manmade staple fibers and their blends. (ATxE0702)

7.3. Classification of dyes and their use in Textile dyeing and printing. Difference between dyes and pigments. Optical brightening agent. (ATxE0703)

7.4. Chemistry of Dyeing cotton, wool, silk, polyester, nylon and acrylic with appropriate classes of dyes. (ATxE0704)

7.5 Chemistry of Dyeing polyester/cotton, Polyester viscose and polyester/wool blends.(ATxE0705)

7.6 Types of dyeing machines used for dyeing of fiber, yarn and fabrics. Dyeing processes and machines for cotton knitted fabrics; Dye-fiber interaction. (ATxE0706)

8. Chemical Processing / wet processing II (ATxE08)

8.1. Brief idea about the relation between colour and chemical constitution; Beer-Lambert's law; Kubelka-Munk theory and its application in colour measurement. Colour theory. primary, secondary and tertiary colours. (ATxE0801)

8.2. Various finished fabric properties and their importance such as wash, light and rubbing fastness. Spectrophotometer and their application in dyeing and printing. (ATxE0802)

8.3. Methods of printing such as Block, roller printing and screen printing; Transfer printing of polyester; Inkjet printing; Their advantages and limitations. (ATxE0803)

8.4. Preparation of printing paste; Various types of thickeners; Printing auxiliaries; Direct styles of printing of (i) cotton with reactive dyes, (ii) wool, silk, nylon with acid and metal complex dyes, (iii)

polyester with disperse dyes; Resist and discharge printing of cotton, silk and polyester; Pigment printing; Printing faults. (ATxE0804)

8.5. Classification of surface active agents, its properties and various applications in wet processing. Chemistry, mechanics and theories and application of wetting agent, detergents, levelling and dispersing agents in Textile processing. Evaluation of detergency. (ATxE0805)

8.6. Mechanical finishing of cotton; Stiff, soft, wrinkle resistant, water repellent, flame retardant and enzyme (bio-polishing) finishing of cotton. Milling, decatizing and shrink resistant finishing of wool; Antistatic and soil release finishing; Heat setting of synthetic fabrics. (ATxE0806)

9. Safety, waste management and quality control: (ATxE09)

9.1 Types of hazards in Textile industries, Hazards due to high pressure & explosions, dust & inflammable materials, toxic materials, chemicals, etc.; Noise hazards effects of noise hazards on personnel and plant operation; (ATxE0901)

9.2 Occupational health and safety management, safety culture; storage of dangerous materials; Safety protection, equipment for personal & plant for various hazards, Safety procedures; Disaster management, insurance, worker's safety Act (ATxE0902)

9.3 Concepts and definition of pollution, Sources and effects of environmental pollution, air pollution, water pollution, land pollution, environmental laws & standards; (ATxE0903)

9.4 Management of industrial waste reuse, recycling, impact of pollution on environment and It's assessment; Magnitude of industrial waste problem, hazardous waste disposal and effluents, effluent standards and stream standard. (ATxE0904)

9.5 Solid-waste disposal and recovery of useful products: Modification; recovery of by-products; energy recovery; waste utilization and recycle and reuse; Waste Minimization; Environmental Policy, Act and Regulations, ISO 14001; Concept of Cleaner Production (ATxE0905)

9.6 Quality and quality control, Quality Circle, Total Quality Management, Quality Management System, Standardization and Certification, Nepal Standard (Certification Mark) Act 2037, Regulation 2040, Consumer Protection Act (ATxE0906)

10. Project Planning, Design and Implementation: (AALL10)

10.1 Engineering drawings and its concepts: Fundamentals of standard drawing sheets, dimensions, scale, line diagram, orthographic projection, isometric projection/view, pictorial views, and sectional drawing. (AALL1001)

10.2 Engineering Economics: understanding of project cash flow; discount rate, interest and time value of money; basic methodologies for engineering economics analysis (Discounted Payback Period, NPV, IRR & MARR); comparison of alternatives, depreciation system and taxation system in Nepal. (AALL1002)

10.3 Project planning and scheduling: project classifications; project life cycle phases; project planning process; project scheduling (bar chart, CPM, PERT); resources levelling and smoothing; monitoring/evaluation/controlling. (AALL1003)

10.4 Project management: Information system; project risk analysis and management; project financing, tender and its process, and contract management. (AALL1004)

10.5 Engineering professional practice: Environment and society; professional ethics; regulatory environment; contemporary issues/problems in engineering; occupational health and safety; roles/responsibilities of Nepal Engineers Association (NEA). (AALL1005)

10.6 Engineering Regulatory Body: Nepal Engineering Council (Acts & Regulations). (AALL1006)