

SCHEME OF STUDIES FOR THE FOUR SEMESTERS

MASTER OF TECHNOLOGY (M.TECH) (TT/TC) DEGREE COURSE

M.TECH (FIRST SEMESTER)

<u>Index No.</u>	<u>Title of Papers</u>	<u>Hours per week</u>
TT 501	Developments in Fibre Production	4
TT 503	Structure and Properties of Fibres	4
MA 505	Advanced Mathematics & Computer Programming	4

Any one group of the Electives :

Group A

TT 507	Theory and Design of Spinning Machinery	4
TT 509	Modern Technology of Fabric Production	4

Group B

TC 507	Chemistry of Dyes	4
TC 509	Advances in Theory of Dyeing	4

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SECOND SEMESTER

MA 502	Operations Research & Design of Experiments	4
EN 504	Instrumentation and Automatic Control	4
TT 506	Developments in Texturing	4

Any one group of the Electives :

TT 508	Theory and Design of Weaving Machinery	4
TT 510	Structural Engg of Fibre Assemblies	4
TT 512	Unconventional Spinning Systems	4

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SCHEME OF EXAMINATION FOR THE FOUR SEMESTERS

MASTER OF TECHNOLOGY (M.TECH) (TT/TC) COURSE

FIRST SEMESTER

Index No.	Title of Paper	No. of Papers	Time (Hrs)	Marks of Paper	Marks of C/Work	Total Marks
TT 501	Developments in Fibre Production	1	3	100	50	150
TT 503	Structure & Properties of Fibres	1	3	100	50	150
MA 505	Advance Mathematics & Computer Programming	1	3	100	50	150
Any one group of the Electives						
Group A						
TT 507	Theory & Design of Spinning Machinery	1	3	100	50	150
TT 509	Modern Technology of Fabric Production	1	3	10	50	150
Group B						
TC 507	Chemistry of Dyes	1	3	100	50	150
TC 509	Advance in Theory of Dyeing	1	3	100	50	150

SECOND SEMESTER						
MA 502	Operations Research & Design of Experiments	1	3	100	50	150
EN 504	Instrumentation & Automatic Controls	1	3	100	50	150
TT 506	Developments in Texturing	1	3	100	50	150
Any one group of the elective:						
TT 508	Theory & Design of Weaving Machinery	1	3	100	50	150
TT 510	Structural Engg of Fibre Assemblies	1	3	100	150	150
TT 512	Unconventional Spinning Systems	1	3	100	50	150
Group B						
TC 508	Textile Chemicals & Analytical Methods	1	3	100	50	150
TC 510	Modern Methods of Dyeing & Printing	1	3	100	50	150
TC 512	Advances in Textile Finishing & Allied Processes	1	3	100	50	150

SYLLABUS – First Semester

TT 501 Developments in Fibre Production 4(150)

Fibre modification and evaluation of their properties. Advances in fibre extrusion processes and discussion on structure and properties of the product. Developments in post extrusion operations.

New fibres based on performance and functional applicability. High temperature resistant fibres – Nomex, Kelvar, PBO – production, properties, structure and applications. High strength, high modulus fibres – Spectra (UHMWPE) – production, properties, structure and application. Different routes for production of carbon fibres, their structure, properties and end uses. Optical fibres – Different type, Signal losses, their remedy, production and properties and uses.

Geotextiles – definition, properties, usage.

Spin finish – their properties, uses and necessity.

TT 503 Structure and Properties of Fibres 4(150)

Study of fibre structure by X-rays, IR Spectroscopy, optical and electron microscopy. Determination of degree of crystallinity, orientation, crystal size and morphology.

Structure of fibres, morphology and order in fibre structure. Theories of fine structures of fibres.

The Mechanical properties of fibres. Theories of elasticity. Thermodynamics analysis of deformation. Rubber elasticity of long chain molecules and molecular network. Application to fibres. Theories of viscose-elasticity.

Stress relaxation, creep, stress-strain relations, Temperature of visco-elasticity as applied to natural fibres. The Boltzman supervision principle and Nutting's Power Law, their application to fibres.

Sorption isotherms, heat of sorption, swelling and theories of moisture sorption.

Di-electric properties. Effects of frequency and temperature on dielectric constant and static electricity.

Frictional properties – Theory of friction and lubrication and its application to fibres. Measurement of friction. Thermal and optical behaviour of fibres.

MA 505 Advanced Mathematics and Computer Programming 4(150)

Partial Differential Equations. First order linear equations. Four standard forms of non-linear equations. Linear equations with constant coefficients. Equations of strings, heat-flow and electrical transmission lines.

Integral Transform: Fourier transforms and their operational properties, Fourier integral theorems, inversion theorems, laplace transforms and their operational properties, Inversion theorem. Heviside's unit step function, Dirac delta function, error function and their Laplace transforms.

Applications of transforms to solution of one dimensional wave and diffusion equation.

Computer Programming: Basic concepts of FORTRAN Arithmetical expressions, Do Statement and transfer of control statement. Subscripted variables. Simple input and output statements with simple FORMAT specifications I.E.F.X.H. Sub-programs and sub-routines. Simple programs in FORTRAN Language including Gauss-Seidel Method, Newton-Raphson Method, Simpson's Method.

Group A

TT 507 Theory and Design of Spinning Machinery 4(150)

Design principles of modern openers and blenders. Feed Regulation. Theories of carding. Design aspects of high production cards.

Effects of lap preparation on carding efficiency. Drafting force. Theories of drafting. Mechanism of hook removal during drafting. Autolevelling. Developments in high speed fly frames. Twist flow in Ring Spinning, Spinning Tension. Developments in design of ring travelers. Spindles and high speed ring frame. Automated Spinning.

TT 509 Modern Technology of Fabric Production 4(150)

Classification of non-woven fabrics. A survey of non-woven field – its uses and future growth.

Principles of web formation. Properties of different type of webs

Fibre properties and their influence on properties of non-woven fabrics. Web geometry – fibre orientation, curl-factor and web density their effect on properties of non-woven fabrics.

Classification of binders and methods of binder application. Binder properties and effect of binder-fibre adhesion on properties of non-woven fabrics.

Needle bonded non-wovens; processing variables and their effects on properties.

(Definitions and problems only). Univariate Binomial, Poisson and normal distributing (properties and applications).

Tests of hypothesis and significance: Concept of sampling. Types of sampling, sampling distribution of means, proportions, difference of means and difference of proportions. Definitions of statistical hypothesis, Type I and II errors and level of significance.

Tests of significance for large and small samples. Problems based on X^2 -test for goodness of fit, t test, F-test and analysis of variance (one way and two way classifications).

Reading List

Title Author

Operations Research Methods and Practices	CK Mustafi
Operations Research	Kantiswarup, PK Gupta, Manmohan
Operations Research	Gupta and SD Sharma
Business Statistics	Gupta and Gupta
Mathematical Statistics	Gupta and Kapur
Theory and problems of probability and Statistics	MP Spiegel

EN 504 Instrumentation and Automatic Control 4(150)

Automatic Control : Introduction to control systems, concept of feed back. System representation – Schematics and block diagrams, dynamic equations of physical systems. Transfer functions, system response to impulse, set-up, ramp and sinusoidal inputs.

Steady state errors and error constant, absolute and relative stability, Routh and Nyquist criteria, Bode analysis, Basic Control actions and industrial automatic control. Control system design and compensation techniques in the s-plane.

Instrumentation: Principles of measurement, Sensor transducers for the measurement of force, acceleration, velocity, displacement pressure, temperature, strain, light-intensity and electrical parameters applications of transducers in industrial processes and quality control.

TT 506 Developments in Texturing 4(150)

Different types of texturing – Twist texturing, Air-jet texturing, edge crimping stuffer box crimping, gear crimping, knit-de-knit etc.

Detailed discussion on F.T. texturing process, machine, Material, process and machine variables – their effect on properties of yarn. Recent developments.

Airjet texturing – detailed discussion of process. Different types of variables and their effect on properties of yarn. Recent developments of airjet texturing machine, jets and process.

Methods of assessing and evaluation of textured yarns. Hi-bulk yarns – especially acrylic. Chemical texturing and texturing of staple yarns.

Group A

TT 508 Theory and Design of Weaving Machinery 4 (150)

Theory, measurement and control of yarn tension in unwinding from spinning packages during winding.

Study of warp tension variation during winding,

Development in design and operation of modern winding, warping, sizing machines. Theory and design principles of latest automatic controls in size regulation in sizing. Factors affecting size pick up and drying rate in sizing. Expression for drying capacity of sizing machine.

Kinematics of loom slay, Picking system elastic model, shuttle checking.

Cloth fell equation and its applications

Design problems of conventional weavings.

Principles underlying unorthodox weaving machinery picking system : toggle torsion bar picking, airjet nozzle, waterjet nozzle, rapier drives.

Kinematics of weft population in unconventional weaving machines : air drag theory.

Loom timings for shuttleless looms.

TT 510 Structural Engg of Fibre Assemblies 4(150)

Elements of yarn geometry. Geometry of helix and its application to yarn structure. Geometry of folded yarns.

Translation of fibre properties into yarn behaviour. Theories of yarn irregularity and blend irregularity. Theories of machines of yarn structures under tension, compression, bending and shearing.

Fibre migration characteristics of spun and continuous filament yarns. Concept of similar yarns. Effect of properties of constituent fibres and blend composition on the behaviour of composite yarns.

Theories of cloth setting. Geometry of woven fabrics based on the assumption of flexible rigid threads. Application of fabric geometry in fabric weaving and processing.

Later modifications to Peirce’s fabric geometry. Use of weavability graphs. Effect of yarn properties and their configuration in fabric on fabric properties such as extensibility, stiffness and drape. Distribution of stress in fabrics under elongation, beidnign, buckling and shearing. Effect of fabric relaxation on its properties.

TT 512 Unconventional Spinning Systems 4(150)

Causes leading to advent of unconventional spinning systems. Principles and Engineering Design of rotor, air-jet and friction spinning. Structure & properties of these unconventional yarns. Effect of raw material and machine variables on yarn characteristics. Plying of these yarns.

Other unconventional spinning systems, viz. Self twist, Twist less, Integrated, Disc, Parafil, etc – their working principles, properties and end use of yarns spun on these system.

GROUP B

TC 508 Textile Chemicals & Analytical Methods 4(150)

Colloidal & Surface Chemistry as applied to textile chemicals, preparation and properties of anionic, cationic and nonionic surface-active agents. Chemistry of Thermosetting and thermoplastic resins, Mechanism of crease resistance.

Theory & Instrumentation techniques and application of absorption chromatography. Absorption spectroscopy, Mass spectroscopy. Evaluation of dyes and finishes.

TC 510 Modern Methods of Dyeing & Printing 4(150)

Combined preparatory processes. Processing of textured man-made fibers. Rapid dyeing techniques, Foam dyeing and other advanced dyeing techniques. Developments in transfer printing of natural as well as synthetic fibers. Developments in dyeing and printing machineries.

TC 512 Advances in Textile Finishing & Allied Processes 4(150)

Developments in textile finishing such as resin finishing, soil release, flame proofing, antistatic, etc. Foam finishing technology. Developments in finishing machineries.

Air and water pollution, disposal of waste and effluents and related processes.

SCHEME OF EXAMINATION

THIRD SEMESTER

Index No.	Theory Papers	No. of papers	Time (Hrs)	Marks of Papers	Marks of C/Work	Total Marks
TT 601	Design of Experiments & Quality Control	1	3	100	50	150
TT 603	Technical Textiles	1	3	100	50	150
TT 605	Mid-term Evaluation of Project / Seminar	1			100	100
FOURTH SEMESTER						
TT/TC 602	Dissertation & Viva-Voce	1	2	500	-	500

SYLLABUS – Third Semester

TT 601 Design of Experiments & Quality Control 3(150)

Section I (Two questions)

Regression and Correlation:

Significance of the study of correlation, Karl Pearson's coefficient of correlation, Rank correlation coefficient, Method of least squares, Regression Lines, Regression equations of Y and X, Least square parabola, Partial correlation coefficients (Three variables only)

Multiple correlation and Regression.

Section II (Two questions)

Statistical Quality Control:

Meaning of Statistical Quality Control, Control charts, namely, X,R,C and p charts. Benefits and limitations of SQC, acceptance sampling, selection of sampling plan. Construction of an OC curve.

Section III (4 questions)

Overview of measures of dispersion, random variates, probability distribution and testing of hypothesis.

Principles of experimental design, selecting a statistical design, analysis of variance (one way and two way clarifications) running experiments in blocks, Latin Squares, factorial design (a discussion). Use of replicates. Numericals based on Fractional design namely, 2^3 experiments 3^3 experiments. Compounding in 2^3 and 3^3 experiments. Split plot and strip plot designs.

Reading List

Title Author

Design and analysis	Das & Giri
Fundamentals of statistics (Vol-II)	Goon, Gupta & Das Gupta
Fundamentals of statistics	Gupta & Kapoor
Business Statistics	Gupta & Gupta

TT 603 Technical Textiles 3 (150)

Introduction: Definition, Textile materials in technical applications.

Fibres: Natural and Man-made fibres suitable for technical applications and their relevant properties.

Geotextiles: Mechanics of reinforcement, filtration and drainage of soils by geotextiles. Typical applications. Determination of soil particle size and pore size distribution, relations between soil particle and size and pore size distribution for hydraulic applications.

Medical textiles: Textiles in various medical applications. Absorbency of textile materials & methods of sterilization; application oriented design of typical medical textiles (e.g. porous graft or trashed tube). Materials used and design procedure for protecting wounds, cardiovascular application, Sutures etc.

Automotive Textiles: Fibres used for automotive applications-upholstery, carpeting, preformed parts, tyres, safety devices, filters and engine compartment items. Brief description for the manufacture and application of these devices or parts.

Rigid composites: Three dimensional fabrics and triaxially braided materials for composites.

Filtration: Principles and some mathematical models of wet and dry filtrations. Characteristics properties of fibres and fabrics in selective examples of filtration.

Ropes and Cordages: Methods of production. Application oriented structure and production of ropes, cordages and twines.

Protective clothing: Thermal protection. Ballistic protection. Protection from electromagnetic radiation and static hazards. Protection against micro-organisms, chemicals and pesticides.

TT 605 **Mid-term Evaluation of Project Work / Seminar** **(100)**

FOURTH SEMESTER

TT/TC 602 **Dissertation & Viva-Voce** **(500)**

Each student individually will carry out a project of an experimental and/or theoretical nature in one of the main branches of textile technology/textile chemistry and present his findings in a systematic manner in the Project Report duly approved and signed by his Supervisor / Guide (to be nominated by the Director, TITS). Each candidate would submit three (3) typed copies of the Project Report to Director, TITS at least 15 days before the commencement of fourth semester examination. One copy of the Project Report will be returned to the candidate after viva-voce examination. The original report and a carbon copy will be retained by the concerned Department / Institution and the Supervisor respectively.