Syllabus of M.Tech in Chemical Processing of Textiles effective from the year 2013
(Under West Bengal University of Technology)

1st semester

Theory:							
Code	**Subject**	**Contacts periods per week**				**Full marks**	**Credit**
		L	**T**	**P**	**Total**		
MCP/ MTT 101	Advanced Engg. Math.	3	1	0	4	100	4
MCP/ MTT 102	Physical Properties of Textile Fibres	4	0	0	4	100	4
MCP 103	Theory and Practices of Coloration	4	0	0	4	100	4
MCP 104	Polymer and Fibre Chemistry	4	0	0	4	100	4
MCP/MTT 105	**Elect I: (A**) Applied Statistics & Quality Control in Textile Industries(B) Computational Methods in Textile	4	0	0	4	100	4
	Total of theory				**20**	**500**	**20**
Practical							
MCP/MTT 191	**Lab I:** Physical Properties of Textile Fibres	0	0	3	3	100	2
MCP 192	**Lab II:** Theory and Practices of Coloration (Practical)	0	0	3	3	100	2
	Total of practical				**6**	**200**	**4**
Sessional							
MCP 193	Seminar I	0	2	0	2	100	1
	Total credit of 1st semester				**28**	**800**	**25**

2nd semester

Theory:							
Code	**Subject**	**Contacts periods per week**				**Full marks**	**Credit**
		L	**T**	**P**	**Total**		
MCP / MTT 201	Industrial Management	4	0	0	4	100	4
MCP 202	Textile Chemical and Ecology	4	0	0	4	100	4
MCP 203	Principles of Colour Measurement and Communication	4	0	0	4	100	4
MCP 204	Elect II: (A) Theory and Practices of Textile Finishing (C) Advanced Fibre Technology	4	0	0	4	100	4
MCP/MTT 205	Elect III: (A) Electro-active Textiles (B) Plasma Technology (C) Eco-textiles (D) Theory of Manmade Fibre Production and Texturising	4	0	0	4	100	4
	Total of theory				**20**	**500**	**20**
Practical							
MCP 291	**Lab III:** Colour Measurement and Ecology Lab	0	0	3	3	100	2
Sessional	**n**						
MCP 292	Term paper leading to thesis	0	2	0	2	100	1
MCP 293	Comprehensive Viva-Voce					100	4
	Total credit of 2nd semester				**26**	**800**	**27**

3rd semester

Theory:				
Code	**Subject**	**Contacts periods per week**	**Full marks**	**Credit**

		L	T	P	Total		
Sessional							
MCP 391	Dissertation (Part-I)				24	100	4
MCP 392	Defence of dissertation (Part-I)					100	8
	Total credit of 3rd semester:				**32**	**400**	**20**

4TH semester

Sessional:							
Code	**Subject**	**Contacts periods per week**				**Full marks**	**Credit**
		L	**T**	**P**	**Total**		
Sessional							
MCP 491	Dissertation (Completion)				24	100	6
MCP 491	Post-submission defense of dissertation					100	18
	Total credit of 4th semester:				**24**	**200**	**24**
	Grand Total of credits:						**96**

Detailed syllabus

MCP/ MTT 101 **Advanced Engg. Math.**

Fourier series and Transform: Revision of Fourier series, integrals and transforms and their properties. The 2-dimensional fourier transform, convolution theorem, Parseval's formula, discrete fourier transform, fast fourier transform ; (5)

Optimization Technique: Calculus of several variables, Implicit function theorem, Nature of singular points, Necessary and sufficient conditions for optimization, Elements of calculus of variation, Constrained Optimization, Lagrange multipliers, Penalty function,Gradient method, Dynamic programming; (9)

Partial Differential Equations: Solutions of Wave equation, Heat equation and Laplace's equation by the method of separation of variables and their use in problems of vibrating string, one dimensional unsteady heat flow and two dimensional steady state heat flow including polar form. Two Dimensional wave equation; (9)

Graph Theory: Graphs and planar graphs : Basic terminology, multigraphs and weighted graphs, paths and circuits, shortest paths in weighted graphs, Eulerian paths and circuits, Hamiltonian paths and circuits. Trees and cut-sets : trees, rooted trees, path lengths in rooted trees, spanning trees and BFS & DFS algorithms, minimum spanning trees and Prims & Kruskal's algorithms . (9)

Numerical analysis: Cubic spline,B splines Bezier curves and surfaces ;ordinary diff equation Series solution, methods of Milne, Adams-Bashforth, MilneSimpson multistep and Runge-Kutta methods. Difference equations; numerical solution, relaxation method. Solution of partial differential equations by difference methods. Numerical solutions of elliptic, parabolic and hyperbolic partial differential equations. (10)

Books:

1. John B. Conway, Functions of one complex variable, Springer International.
2. James Ward Brown & Ruel V. Churchill, Complex variable and application., Mc Graw Hill International edition .
3. John H. Mathews, Numerical Methods for Mathematics , science and Engineering, PHI
4. D.C. Sanyal and K. Das, A text Book of Numeriacl analysis, U.N. Dhar & Sons Pvt. Ltd.
5. S.S.Rao,, Optimisation theory and application, Wiely Eastern limited
6. E.Kreyszig,Advanced Engineering Mathemetics,Jhon Wiley & Sons,2001
7. Hoffman & Kunze. R, Linear Algebra, PHI

MCP/ MTT 102 Physical Properties of Textile Fibres

Unit	Content
1	Fine structure of textile fibre, Mechanism of deformation in fibres, Principles of elasticity and visco-elasticity, Stress-strain relations, creep, stress-relaxation, time-temperature effect, dynamic mechanical properties, Different model theories of visco-elasticity. Thermodynamic analysis of mechanical deformation and rubber elasticity,
2	Setting of textile fibre, fibre friction, optical properties of fibres, Refractive index and birefringence.
3	Moisture sorption and desorption in fibres, Swelling of fibre.
4	Dielectric properties, effect of frequency and temperature on dielectric constant, Electrical resistance and its measurement, Static electricity and measurement of static charge in fibres.

Text Books:

1. Physical properties of fibre, Hearle and Morton;
2. Manufactured fibre Technology, V.B Gupta and V.K Kothari;
3. The Mechanical Properties of Textile Fibers von *R. Meredith*.;
4. Introduction to Polymer, Robert J. Young.

MCP 103: Theory and Practices of Textile Coloration

Unit	Content
1	Eco-friendly preparatory Processes – advancement in desizing, scouring and bleaching, hydrogen peroxide and peracetic acid bleaching. Eco-friendly stabilizers for peroxide bleaching. Developments in singeing. Combined preparatory processes. Hot and ammonia mercerization, add-on mercerization. Advance preparatory machines and accessories.
2	Use of biotechnology in pretreatments, classification and of enzymes in textile processing, Mode of action of enzyme, Factors affecting efficiency of enzyme treatment.
3	Eco-friendly dyeing processes for various textile fibres. New developments in reactive dyes like high fixation dyes, low and no salt reactive dyes, multifunctional reactive dyes, new development in acid and disperse dyes, photo chromic dyes, thermo chromic dyes, fluorescent dyes.

4	Natural Dyes - Sources and classification of natural dyes, mordants, dyeing with natural dyes. Dyeing of blends, mass coloration of man-made fibres.
5	Denim, garment and terry towel processing. Super critical Carbon dioxide dyeing – concept, mechanism, methods. Development in dyeing machinery. Auto-dispensing systems.
6	Thermodynamics and kinetics of dyeing. Role of fibre structure in dyeing.
7	Direct, resist and discharge styles of printing. Printing of blends. Transfer printing. Developments in Digital printing.
8	Brief idea about green chemistry and greener approaches in textile coloration.

Text Books:

1. R.H. Peters. 1967, *Textile Chemistry*, *Volume II* (Amsterdam, Netherlands: Elsevier).
2. The Dyeing Of Textile Materials by J. Cegarra, P. Puente, J. Valldeperas,
3. Engineering in Textile Colouration by C. Duckworth,
4. Dyeing and Chemical Technology of Textile Fibres by E.R. Trotman,
5. Textile Preparation and Dyeing by A. K. Roy Choudhury (The Society of Dyers & Colourists,India).
6. Basic Principles of Textile Coloration by Arthur D Broadbent, SDC
7. Colorants and Auxiliaries, Vol. 1 by J. Shore, 2010, SDC.
8. Handbook of textile and industrial dyeing: Volume 1: Principles, processes and types of dyes, ISBN 1 84569 695 6, Woodhead, UK
9. Handbook of textile and industrial dyeing: Volume 2. Applications of dyes, ISBN 1 84569 696 4, Woodhead, UK

MCP 104: Polymer and Fibre Chemistry

Unit	Content
1	Introduction to natural and synthetic polymers. Terms and fundamental concepts. Functionality and Cross-linking.
2	Step-growth polymerization, Carothers's equation, Chain growth polymerization, Free radical polymerization, Kinetics of free-radical polymerization, initiator, termination, chain transfer, Mayo's equation, cage effect, auto-acceleration, inhibition and retardation. Atom transfer radical polymerization, ionic polymerization, ring opening polymerization.
3	PET manufacturing, Polypropylene manufacturing, Acrylic manufacturing and Nylon-6 manufacturing.
4	Co-polymerization and its importance. Copolymer equation, reactivity ratio, tailor

	making of copolymer properties.
5	Techniques of chain polymerization. Bulk, solution, emulsion, microemulsion and suspension polymerization.
6	Chemical Modification of fibres. Polymer solution, Floras theory and Interaction parameter.
7	Molecular weight and its distribution by End group analysis, osmometry, light scattering, ultra centrifugation, gel permeation chromatography, intrinsic viscosity. Spectroscopic methods of polymer characterisation such as, PTIR. UV, NMR.

Text Books:

1) Polymer Science: Vasant R. Gowariker, N. V. Viswanathan, Jayadev Sreedhar, New Age International, 1986.
2) Textbook Of Polymer Science, F.W. Billmeyer, Wiley-Interscience.
3) Physical Chemistry of Polymers, Anna Tager, MIR Publishers, Moskow.
4) Properties of Polymers: Their Correlation with Chemical Structure , D.W. van Krevelen, Klaas te Nijenhuis, Elsivier, Amsterdam, 1982.
5) Introduction to Polymers by Robert Joseph Young, P. Peter A, Chapman and Hall, London, 1981
6) Textile science, E. P. G. Gohl, L. D. Vilensky, Longman Cheshire, 01-Jan-1983.

MCP/MTT 105 Elect I: (A) Applied Statistics & Quality Control in Textile Industries

PROBABILITY DISTRIBUTION AND ESTIMATION: Introduction to probability distributions – discrete distributions and continuous distributions; Applications of Binomial, Poisson, Normal, Student's't', Chi-square, and F distributions in textile manufacturing. (5)
TESTS OF SIGNIFICANCE: Concept of hypothesis testing, Errors in hypothesis testing – Type I and Type II errors; Significance tests – t-test, chi-square test and F-test – applicable to textile quality parameters; selection of sample size and significance levels with relevance to textile applications. (5)
Stochastic process, markov chains, poission process, normal process application in textiles. (3)

ANALYSIS OF VARIANCE: One-way ANOVA, two-way ANOVA, experimental design for ANOVA. (7)
DESIGN AND ANALYSIS OF EXPERIMENTS: Importance of experimental design; Classification of experimental designs – Classical and Taguchi designs; 2k factorial designs – full factorial and fractional factorial designs; 3k factorial designs – design and analysis of second-order composite designs – orthogonal and rotatable designs; fitting regression models; calculation of regression coefficients; adequacy test for the regression equations. Box and Behnken Method applied to textile problem. (8)
EXTREME VALUE MODELLING: Properties of the Weibull model; the characteristic smallest value; two-parameter case and three-parameter case; connections with initial distributions. Application of Weibull distribution in extreme value modelling for yarn strength, fabric strength, etc. (7)
PROCESS CONTROL AND CAPABILITY ANALYSIS: Control charts for variables and attributes-basis, development, interpretation, sensitizing rules, average run length; Capability analysis. Cumulative sum and exponentially weighted moving average control charts, multivariate process monitoring and control (7)

Total 42

REFERENCES:

1. Leaf G.A V, "Practical Statistics for the Textile Industry", Part I and II, The Textile Institute, Manchester, 1984, ISBN: 0900739517.
2. Mayer P L, "Introductory Probability and Statistical Applications", Oxford and IBH Publishing Co., New Delhi, 1970.

3. Akhnazarova S and Kafarov V, “Experiments Optimization in Chemistry and Chemical Engineering”, Mir Publishers, Moscow, 1982.
4. Bury K V, “Statistical Models in Applied Science”, John Wiley & Sons, New York, 1975.
5. Montgomery D C, “Design and Analysis of Experiments”, John Wiley & Sons, New York, 1997.
Brearley A and Cox D R, “An outline of statistical methods for use in the textile industry”, WIRA, 1953

MCP/MTT 105 Elect I: (B) Computational Methods in Textile

COMPUTER VISION BASED IMAGE PROCESSING: Elements of Digital Image Processing – Image formation , Pre-processing techniques, image transforms – enhancement- restoration – encoding. image analysis and feature extraction methods – Application of Image processing to textile process/product feature extraction. (7)

ARTIFICIAL NEURAL NETWORKS: Introduction to artificial neural networks, basic models like Hopfield networks, multilayer perceptron and learning vector quantization networks, self-organizing feature maps-their properties and applications ;Basic concept – Inference and Learning – models – supervised & unsupervised learning- Knowledge based Neural Networks. Application of ANN to Fabric defect analysis, pattern recognition –prediction of clothing performance, garment manufacturing – classification of patterns. Support vector machine ,cluster algorithm (9)

ARTIFICIAL INTELLIGENCE AND DECISION SUPPORT SYSTEMS: Scope of artificial intelligence – structures of Expert and Decision support systems – Application – Spinning, weaving and garment unit Application of DSS to Fabric defect analysis . (5)

Introduction to fuzzy sets and its importance in real life. Definition, basic operators, T-norm , S-norm, other aggregation operators. Fuzzy relation, implications, cylindrical extension, projection and composition, Approximate reasoning, compositional rule of inference, rule based system, term set,fuzzification, reasoning, defuzzification, different fuzzy models (MA/TS)- some applications of fuzzy rule based system. (6)

An Introduction to Genetic Algorithms,Theoretical Foundations of Genetic Algorithms,Genetic Algorithms in Engineering and Optimization,Genetic Algorithms in Natural Evolution,Simulated Annealing and Tabu Search, Studies of Hybrid(neuro-fuzzy, fuzzy-neutral and fuzzy -GA) systems and applications (6)

Monte Carlo Principle ,Simple Simulation Methods, Sequential Monte Carlo Methods,Markov Chain Monte Carlo simulation of univariate and multivariate normally distributed random variables: Box-Muller and Marsaglia methods, variance reduction techniques, generation of Brownian sample paths, quasi-Monte Carlo.Methods.examples (4)

MODELING AND SIMULATION: Introduction – Basic modeling concepts, methods, FEM Technique. Modelling and Simulation of textile structures Basics of computer graphics – graphic input techniques – Two dimensional transformation – 3-D concept. (5)

Total 42

REFERENCES:

1.Gonzalez R C and Wintz P, “Digital Image Processing”, Pearson Education second edition 2002.
2.Patterson D W , “Artificial Intelligence and Expert System”, Prentice Hall of India, 1996.
3.Rajaram V, “Analysis and Design of Information systems”, Prentice Hall of India, 1992.
4. Goldberg - Genetic algorithm, Pearson 2003
5.S-Rajasekaran and G-A Vijayalakshmi Pai-’Neural Networks- Fuzzy logic andGenetic Algorithms-Synthesis and Applications’- Prentice Hall of India- New Delhi-2003
6. Nils-J-Nilsson- “Artificial Intelligence- A new synthesis’- Morgan Kauffmann Publishers Inc- San Francisco-California-1998
7.Freeman - Neural Networks, Pearson 2003
8. Jang - Neuro-fuzzy and soft Computing, Pearson 2003
9.Melanie Mitchell- ’An introduction to Genetic Algorithm’- Prentice-Hall of India- New Delhi- Edition: 2004
10 David-E-Golberg- ’Genetic algorithms in search- optimization and machine learning’- Addision-Wesley-1999
11.Min Fu, “Neural Networks in Computer Intelligence”, Mc Graw Hill Inc, 1994.
12.Fuzzy Logic with Engineering Applications Timothy J. Ross (Author)3rd Edition Wiley 2009

13. Monte Carlo Strategies in Scientific Computing, Springer Series in Statistics, by J. S. Liu
14.Monte Carlo Statistical Methods, Springer Texts in Statistics, by C. P. Robert and G. Casella
15.P. Glasserman, Monte Carlo Methods in Financial Engineering, Springer, 2004.

MCP/MTT 191 Lab I: Physical Properties of Textile Fibres

Laboratory Experiment	
1	Microscopic studies of fibre structure and swelling
2	Study of Moisture sorption and desorption of different fibres
3	Study of creep behaviour on different fibres
4	Study on Fatigue of different fibres,
5	Study of optical properties on different fibres
6	Thermal analysis such as DSC, TGA, TMA, etc. of fibres.
7	Characterization of fibres by Infrared Spectroscopy.

MCP 192 Lab II: Theory and Practices of Coloration (Practical)

Laboratory Experiment	
1	Modern methods of dyeing
2	Modern methods of printing.
3	Various experiment related to dyeing
4	Evaluation of dyes, dyed and printed material following standard methods.
5	Fastness testing.

MCP / MTT 201 Industrial Management

1. ***Classification and importance of Operations Management*** ***4L***
   Operations management in corporate profitability and competitiveness; Types & characteristics of manufacturing systems and service systems

2. ***Operations Planning and Control*** ***10L***
   Management and control of cost; Forecasting for operations; Purchases finance marketing and sales; Operation research; EOQ Model, MRP concept and calculation; Inventory planning & control

3. ***Quality Assurance*** ***5L***
   The quality assurance system; control of quality; quality standards; Cost of Quality; ISO system

4. ***Management Information system*** ***10L***
   Communication; Motivating personnel; Leadership quality; production planning and control; Concept of Production and Productivity wage and salary structure; concept of Total Productive Maintenance

5. ***Case Study of Textile Industry*** ***6L***
   Concept of machine scheduling: Case Study – I; Concept of Manpower allocation: Case Study – II; Concept of grievance handling: Case Study - III

MCP 202 Textile Chemical and Ecology

Unit	Content
Textile Chemicals	
1	Surface active agents, HLB value and the property of surfactants, Classification of textile auxiliary chemicals by function, such as electrolytes, pH controlling agents, sequestering agents, wetting, emulsifying and rewetting agents, dispersing agents and solubilising agents, levelling and retarding agents, thickening agents, migration inhibitors, hygroscopic agents, dye-fixing agents. Foaming and defoaming agents used in textile printing. Optical brightening agents and whiteness measurement.
Ecology	
2	Environmental problems and human health. Toxicological considerations of textile processing. Pollutants and their effects, Factors polluting water in textile wet processing in each unit operation like desizing, scouring, bleaching, dyeing, printing & finishing. Eco-label.
3	Methods of treatment of textile effluent, preliminary, primary, secondary and tertiary treatments. Advancement in the effluent treatment like reverse osmosis, plasma technology, removal of dissolved solids, removal of heavy metals. Sludge disposal, Reuse of water and chemicals, cost of effluent treatment, Norms of treated effluent.
4	A typical design for effluent treatment plant to meet the norms laid down by Pollution Control Board. Measures to be taken into consideration to improve the quality of the effluent generated either by chemical substitution, eco-friendly processing, process modification, etc

Text Books:

1. Textile Preparation and Dyeing by A. K. Roy Choudhury (The Society of Dyers & Colourists,India).
2. H.C. Spiel, and W.K. Schwarte. 1957, *Textile Chemicals and Auxiliaries* (New York, USA: Reinhold)
3. P. Cooper. 1995, *Colorants in Dyehouse Effluent* (Bradford, USA: S D C)
4. Y. Asolekar (co-ordinator). 2000, *Environmental Problems in Chemical Processing of Textiles (*I.I.T. Delhi, India: NCUTE).
5. J. Shore (Eds.). 1990, *Colorants and auxiliaries,* Volume 1 & 2 - Auxiliaries (Bradford, UK: SDC).
6. *Index to Textile Auxiliaries*. 11th Edn. 1988, (Bradford, UK: World Textile Publications).
7. A.M. Schwartz and J.W. Perry. 1949, *Surface Active Agents, Their Chemistry and Technology* (New York,USA: Interscience).

MCP 203 Principles of Colour Measurement and Communication

Unit	Content
1	Basic concept of colour perception, construction of human eye, brief idea about the relation between colour and chemical constitution. Causes of colour generation.
2	Visual description of colour. Colour order systems, types, their utility and limitations. Detailed description of Munsell colour order system.
3	Interaction of light with object – reflection, transmission and scattering, factors governing transmission, Beer's law, Lambert's law, scattering of light and Kubelka-Munk function.
4	Concept and definition of light sources, illuminant and colour temperature. Various light sources and corresponding illuminants. Colour rendering index and colour preference index.
5	Colour measuring instruments – colorimeters, spectrophotometers and their components. Measuring geometry, forward and reverse optics. Instrumental measures of colour, standard observer functions, tristimulus value, chromaticity coordinates and chromaticity diagram, merits and demerits of tristimulus colorimetry. Physical, psycho-physical and psychometric attributes of colour. Uniform colour scales and colour difference equations. Instrumental pass-fail criteria. Measurement of whiteness and evaluation of optical whitening.
6	Brief idea of computer colour matching and formulation.

7	Metamerism, metameric indices, chromatic adaptation and its use. Chromatic transforms and colour constancy.

Text Books:

1. R. McDonald Colour Physics for Industry, SDC publication
2. A.K. Roy Choudhury, " Modern Concept of Color and Appearance" has been published jointly by Science Publishers, Inc., Enfield, NH 03748, USA, pp. 326, $ 49.50 [ISBN 1-57808-078-9] and Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi
3. M L Gulrajani, Colour Measurement: Principles, advances and industrial applications. Edited by Woodhead Publishing Series in Textiles No. 103, ISBN 1 84569 559 3,
4. A.K. Roy Choudhury, Principles of Colour and Appearance Measurement, . Woodhead Publishing Series in Textiles
5. Committee on Colorimetry of the Optical Society of America, *The science of color*, Thomas Y. Cromwell, New York, 1953.
6. K McLaren, *The Colour Science of Dyes and Pigments*, Adam-Hilger, Bristol (U.K.), 1983.
7. Kurt Nassau, *The Physics and Chemistry of Colour*, Wiley-Interscience, New York, 1983.
8. H. S. Shah and R. S. Gandhi, *Instrumental colour measurements and computer aided colour matching for textiles*, Mahajan, India, 1990.
9. R W G Hunt, *Measuring Colour*, Ellis Horwood, Chichester (U.K.), 1987.
10. D. B. Judd and G. Wyszecki, *Color in business, science and industry,* 2nd.Ed., John Wiley & sons, New York, 1963.

MCP 204 Elect II: (A) Theory and Practices of Textile Finishing

Unit	Content
Textile Chemicals	
1	Different concept, mechanism of application of chemical finishes by padding, low wet pick up and foam application methods. Modern development on application of textile chemical finishes.
2	Chemistry, properties and application of softening agents, antistatic finishes, water repellent and oil repellent finishes, ant-pilling finishes, soil release finishes, flame retardant finishes, antimicrobial finishes. Concept of UV-A and UV-B, factors affecting UV protection.
3	Principles, practice and chemistry of easy care, durable press, low formaldehyde and zero formaldehyde based cross-linking finishes. Different types of cross-linking catalysts and their working mechanism.
4	Chemical finishing in relation to environmental issues. Surface and polymer treatment using Irradiation technique like – Gamma. Plasma treatment, Nano finishing and other modern technology.

Text Books:

1. Handbook of Fiber Science and Technology, Vol. II, 2.
2. Chemical Processing of Fibers and Fabrics, Part A and B by M. Lewin and S.B. Sello,
3. An Introduction to Textile Finishing by J.T. Marsh,
4. .Technology of Textile Finishing by V.A Shenai,
5. Textile Finishing by A.J. Hall, 12. Chemical After-Treatment of Textiles by H. Mark, N.S. Wooding and S.M. Atlas,
6. Finishing by Pietro Bellini, Ferruccio Bonetti, Ester Franzetti, Giuseppe Rosace, Sergio Vago.
7. Functional finishing –W. Schinlder, Woodhead, UK
8. Textile finishing – Derek Heywood, SDC, UK.

MCP/MTT 204 Elect II: (C) Advanced Fibre Technology

Brief of development of fibre. Definition of 'High Performance Fibre'. Comparative study between Commodity fibre and 'High Performance Fibre'. Chemically resistance fibre, thermally resistance fibre.
Production, properties, structure and application of Glass, Boron, Carbon, Graphite, Aramid, PBO fibre, Phenolic Fibre, Ceramic fibre, Polyblend, Polybenzimidazole fibre, Polyphelene sulphide fibre, Bacterial fibre, Lyocel fibre, UHMW-PE fibre(by Gel-spinning technique).
Production, properties, structure and application of Micro-denier fibre, Artificial silk, Artificial kidney, lungs, blood vessel, Power fibre, Magic fibre for AIDS diagnosis, etc.

Book references:

High-performance Fibre, J W S Hearle, Woodhead Publication; New Fibres, Tatsuya Hongu and Glyn O Philips, Woodhead Publication; Manufactured fibre Technology, V.B Gupta and V.K Kothari.

MCP/MTT 205 Elect III: (A) Electro-active Textiles

INTRODUCTION: Electric conductivity, metal conductors, ionic conductors, Inherently conducting polymers. (4)

CONDUCTIVE YARNS AND FABRICS: Electro spinning process, process variables, formation of yarns & fabrics. Electro active nano fibres & fabrics, nano composites. (8)

CONDUCTING TEXTILE PREPARATION TECHNIQUES: Extrusion, solution coating, In-Situ polymerization. Electrochemical polymerization. Integration of fibre optic sensors and sensing networks. (8)

TESTING & CHARACTERIZATION: Electrical and Electromechanical characterization, surface resistance, EMI shielding efficiency, morphological Characterisation, Environmental effects. Electroactive fabrics and wearable man-machine Interfaces. (10)

TEXTILE SENSORS: Bio-medical sensors, actuators, wearable bio-feed back systems, motion capture, communication textiles, display of ornamental applications. Textile strain sensors, ECG Electrodes. (12)

Total 42

REFERENCES:

1. "Intelligent textiles and clothing", Mattila H.R, The Textile Institute, CRC press, New York, & Washington, Woodhead publishing Ltd.,England, 2006.
2. " Wearable electronics and photonics", Xiaoming Tao, The Textile Institute, Woodhead publishing Ltd.,England,2005.

"Smart textiles for medicine and healthcare, L.Van Langenhove, Textile Institute & CRC press, wood head publishing limited

MCP/MTT 205 Elect III: (B) Plasma Technology

GASES: Masses and Numbers of Atoms, kinetic energy and temperature, means speed Maxwell – Boltezmann distribution, pressure, Avagadro's Laws, number density of gasses, impingement flux monolayer formation time mean free path, probability of collision, collision frequency, energy transfer during collision, gas flow, types.

GAS PHASE COLLISION PROCESS: Collision cross section, elastic and inelastic collusion Ionization, excitation, relaxation, recombination, dissociation, electron attachment, Ion-Neutral collusion, Matastable collision.

PLASMA: Electron and Ion temperature, plasma potential, DC discharges - glow - arc - corona - rf - ecr discharges - conduction in ionized gases. Diffusion: Diffusion and mobility - free diffusion - mobility - ambipolar diffusion - transition diffusion - diffusion in magnetic field and fully ionized plasma. General structures and features: V-I characteristics - cathode layer - positive column - discharge in fast gas flow - glow discharge instabilities and their consequences - thermal instability.
ARC DISCHARGE: Definition and characteristics - features of arc discharge, types of arcs, high intensity arcs, classification of arcs, free burning arc, wall, vortex, electrode, forced convention and magnetically stabilized arcs - Non thermal arcs; low pressure and low intensity arcs, initiation of arcs - low pressure arc with externally heated cathode - plasma temperature, V-I characteristics - electron and gas temperatures.

LABORATORY PLASMA SOURCES/DEVICES: Low temperature plasma generation, transferred and non-transferred arc torches and their characteristics, vacuum plasma torches.

PLASMA DIAGNOSTICS: Electrical probe techniques - spectroscopic methods - charged particle methods - energy balance technique.

Total 42

REFERENCES:

1. Brainan Chapman, “Glow Discharge Processes : Sputtering and Plasma Etching”, John Wiley and Sons, 1980.
2. Milton O’Ring, “Materials Science of Thin Films”, Academic Press, 2002.
3. Lochite W, Holtgrevan” Plasma Diagnostics, , North Holland Publishing Company, 1968.
4. Physics of High Temperature Plasma, George Schmidt., Academic press, New York, 1979.
5. Rossnagel S.M, Cuomo J.J and Westwood W.D. (editors), Handbook of Plasma Processing Technology., William Andrew Publishing, 1990.

MCP/MTT 205 Elect III: (C)Eco-texiles

INTRODUCTION: Structure and stability of the ecosystem. Health of our planet. Nature of textiles. Textile fibre production. Yarn production. Fabric production. Use of textiles. Garman ban on toxic dyes, chemicals and auxiliaries. Present status of textile industry. Action by Government and other organizations. Precautions to be taken by textile industry. Eco-Auditing and Eco-labelling Eco mark. (6)

BIO DEGRADABLE AND SUSTAINABLE TEXTILES: Introduction. Bast fibres. Alginate fibres. Cellulosic fibres and fabric processing. lyocell fibres. Polylactic acid fibres. Poly hydroxyalkanoates and poly caprolactone. Synthetic silks. Biodegradable natural fibre composites. Biodegradable nonwovens. Natural geo textiles. Conversion of cellulose, chitin and chitosan to filaments with simple salt solutions. Soyabean protein fibre. (9)

ECO TESTING: Toxicology of textile dyes.Eco testing instruments-working of Gas Chromatography, Mass Spectrometry, High Performance Liquid Chromatography, Atomic Absorption Spectrometry/Atomic Emission Spectrometry and Plasma Emission Spectrometry. Eco Standards. (9)

ECO FRIENDLY TEXTILE PROCESSING: Super critical fluid textile dyeing technology. Pollution abatement and waste minimization in textile dyeing. Decoloration of effluent with ozone and re-use of spent dye bath. Chemical treatment of textile dye effluent. Biotechnological treatment of textile dye effluent (9)

SUSTAINABILITY AND ECO DESIGN: Building ecodesign in textile and clothing supply chain. Supply chain partnerships for sustainable textile production. Molecular manufacturing for clean and low cost textile production. Use of renewable resource based materials for technical textile applications. Composites made from spinning waste. (9)

Total 42

REFERENCES:

1. Keith Slater, “Environmental Impact of Textiles”, Woodhead Pub. Ltd, Cambridge, 2003. ISBN:1-85573-541-5
2. Blackburn R.S., “Biodegradable and Sustainable Fibres”, Woodhead Pub. Ltd, Cambridge, 2005. ISBN:0-84933-484-5
3. Christie R.M., “Environmental Aspects of Textile Dyeing”, Woodhead Pub. Ltd, Cambridge, 2007. ISBN:978-1-84569-115-8
4. Miraftab M. and Horrocks R., “Eco Textiles”, Woodhead Pub. Ltd, Cambridge, 2007. ISBN-13: 9781-84569-214-8
5. Eco-Textiles’98, Bolton Institute, Bolton, 1998.
6. Eco-Textiles, Special Report, The Bombay Textile Research Association, Mumbai, February, 1996.
7. Eco Friendly Textiles: Challenges to the Textile Industry, Textiles Committee, Mumbai, 1996.
8. Oeko-tex Standard 100, International Association for Research and Testing in the field of Textile Ecology(Oeko-tex), Zurich, Switzerland, January, 1997.
9. Eco-Friendly Textiles, SITRA Focus, Vol.14, No.2, July 1996.

MCP 205 Elect III: (D) Theory of Manmade Fibre Production and Texturising

Unit	Content
1	General theoretical fundamentals, spinnability of fluids, behavior of polymer system in elongational flow, elongation of steady state liquid jets, kinetics of orientation in elongational flow, kinetics of crystallization, rheological behavior of fibre forming melts, effect of spinning condition on the take up tension and fibre properties, spinning orientation and crystallization.
2	Wet and dry spinning, rheological properties of polymer solvent system and their behavior in fibre spinning, solidification of polymer solutions, effect of spinning conditions on structure and properties of solution spun fibre.
3	Concept of false twist draw texturising with reference to heat setting and drawing, function of machine variables and its impact on fibre properties, causes of defects and their remedies. Concepts of intermingling and their importance
4	Theoretical fundamentals of Air Texturising, functions of machine parameters, special characteristics of air textured yarn.

Text Books:

1. Fundamentals of Fibre Formation- The science of spinning and drawing, Andrzej Ziabicki,
2. Manufactured Fibre Technology, VB Gupta & V K Kothari
3. Acrylic fibre Technology and Application, James C Masson
4. Man Made Fibre, Moncrieff
5. Guide to Crimping, Gandhi

Practical
MCP 291 Lab III: Colour Measurement and Ecology Lab

Laboratory Experiment	
Colour Science Lab.	
1	Colour blindness tests of observers by Ishahara Plate test.
2	Colour discrimination tests of observers by Munsell-Farnsworth 100 hue test.
3	Visual assessment of colour – hue, lightness and chroma using Munsell or Scotdic charts.
4	Measurement of colour by spectrophotometer in both transmission and reflectance mode.

5	Quality control of colour using colour difference equations.
6	Brief idea about metamerism.
7	Brief idea about computer colour matching.
Ecology Lab.	
8	Measurement of various parameters of effluents e.g. colour, turbidity, BOD, COD etc. Laboratory experiments on pollution treatments.