



ODISHA UNIVERSITY OF TECHNOLOGY AND RESEARCH

Techno Campus, Mahalaxmi Vihar, Ghatikia, Bhubaneswar-751029.

Syllabus (Effective from 2023-24)

School/ Department: Department of Textile Engineering
Course: M.Tech., Programme: Textile and Chemical Processing (TCP),
Duration: 2 years (Four Semesters)

Abbreviation used:

AC	Audit course	LC	Lab Course	PA	Practical Assessment
PC	Professional Core	PR	Project/ Practical/ Internship	L	Lecture
PE	Professional Elective	SE	Seminar/ Expert Lecture/ Etc.	T	Tutorial
OE	Open Elective	IA*	Internal Assessment	P	Practical
MC	Mandatory/ Common Course	EA	End-Semester Assessment		

Subject Code Format:

A1	A2	B3	C4	C5	C6
School/ Dept. (Offering)		Level	0: AC	Serial Number (01 to 99)	
BH: Basic Sciences and Humanities		1: UG/ Int. Msc. (1 st Year)	1: PC	01/ 03/.../ 19: Odd Sem. (TCP)	
CS: Computer Sciences		2: UG/ Int. Msc. (2 nd Year)	2: PE	21/ 23/.../ 39: Odd Sem. (TE)	
EE: Electrical Sciences		3: UG/ Int. Msc. (3 rd Year)	3: OE	41/ 43/.../ 59: Odd Sem. (Prog-3)	
EI: Electronic Sciences		4: UG/ Int. Msc. (4 th Year)	4: MC	61/ 63/.../ 79: Odd Sem. (Prog-4)	
IP: Infrastructure and Planning		5: UG/ Int. Msc. (5 th Year)	5: LC	81/ 83/.../ 99: Odd Sem. (Prog-5)	
MS: Mechanical Sciences		6: PG (1 st Year)	6: PR	02/ 04/.../ 20: Even Sem. (TCP)	
BT: Biotechnology		7: PG (2 nd Year)	7: SE	22/ 24/.../ 40: Even Sem. (TE)	
TE: Textile Engineering		8: Ph.D.	8:	42/ 44/.../ 60: Even Sem. (Prog-3)	
			9:	62/ 64/.../ 80: Even Sem. (Prog-4)	
				82/ 84/.../ 98: Even Sem. (Prog-5)	

1st Semester

Sl. No.	Subject Type	Subject Code	Subject Name	Teaching Hours			Credit	Maximum Marks			
				L	T	P		IA	EA	PA	Total
1	PC 1	TE6101	Advanced Chemical Processing	3	0	0	3	40	60	-	100
2	PC 2	TE6103	Chemistry of Dyes and Textile Chemicals	3	0	0	3	40	60	-	100
3	PE 1 (Any One)	TE6201	Characterization of Polymer and Fibrous Material CPFM	3	0	0	3	40	60	-	100
		TE6203	High Performance Fibers								
4	MC 1	BH6401	Mathematical Methods in Engineering	3	0	0	3	40	60	-	100
5	MC 2	MS6403	Research Methodology and IPR	2	0	0	2	40	60	-	100
6	LC 1	TE6501	Evaluation of Textile Material Lab	0	0	4	2	-	-	100	100
7	LC 2	TE6503	Textile Chemical Processing Lab-I	0	0	4	2	-	-	100	100
8	AC 1	Any One from the List of AC 1 (Appendix-I)		2	0	0	0	40	60	-	100
Total				16	0	8	18	240	360	200	800



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2nd Semester

Sl. No.	Subject Type	Subject Code	Subject Name	Teaching Hours			Credit	Maximum Marks			
				L	T	P		IA	EA	PA	Total
1	PC 3	TE6102	Advances in Finishing of Textiles	3	0	0	3	40	60	-	100
2	PC 4	TE6104	Sustainability Issues in Textile Chemical Processing	3	0	0	3	40	60	-	100
3	PE 2 (Any One)	TE6202	Manufactured Fiber Technology	3	0	0	3	40	60	-	100
		TE6204	Technical Textile								
4	PE 3 (Any One)	TE6206	Application of Nano Technology in Textiles	3	0	0	3	40	60	-	100
		TE6208	Textile reinforced composites								
5	OE 1	Any One from the List of OE 1 (Appendix-I)		3	0	0	3	40	60	-	100
6	PR 1	TE6602	Project (Specialization Related)	0	0	4	2	-	-	100	100
7	LC 3	TE6502	Textile Chemical Processing and Evaluation Lab-II	0	0	4	2	-	-	100	100
8	AC 2	Any One from the List of AC 2 (Appendix-I)		2	0	0	0	40	60	-	100
Total				17	0	8	19	240	360	200	800

3rd Semester

Sl. No.	Subject Type	Subject Code	Subject Name	Teaching Hours			Credit	Maximum Marks			
				L	T	P		IA	EA	PA	Total
1	PE 4* (Any One)	TE7201	Process Control in Textiles Wet Processing	3	0	0	3	40	60	-	100
		TE7203	Biotechnology in Textiles								
2	PR 2	TE7601	Dissertation (Phase-I)	0	0	24	12	-	-	100	100
Total				3	0	24	15	40	60	100	200

* Virtual/Online Course either offered by OUTR or available in MOOCs platform (No physical class)

4th Semester

Sl. No.	Subject Type	Subject Code	Subject Name	Teaching Hours			Credit	Maximum Marks			
				L	T	P		IA	EA	PA	Total
1	PR 3	TE7602	Dissertation (Phase-II)	0	0	32	16	-	-	100	100
Total				0	0	32	16	-	-	100	100

Credits and Maximum Marks

Sl. No.	Semester	Credits	Maximum Marks
1	1 st	18	800
2	2 nd	19	800
3	3 rd	15	200
4	4 th	16	100
Total		68	1900



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1st Semester

PC 1	TE6101	Advanced Chemical Processing	3	0	0	3
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Module-I

Combined pre-treatment methods: Basic criteria for combining pre-treatment methods, combined desizing and bleaching, scouring and bleaching, desizing - scouring and bleaching of natural, manmade and blended textiles.

Short liquor methods: Concept of short liquor processing, advantages and limitations. Short liquor pre-treatment and dyeing of various textiles.

Fastness determination: Various Fastness criteria of dyed and printed textile. Grading and methods to determine fastness relating to washing, light, perspiration, sublimation and chlorine treatment.

Module-II

Evaluation of auxiliaries: Importance and method of evaluation of wetting agents, optical brighteners, flame-retardants, water repellents and soil release agents.

Reduction in wastage of energy: Development of new continuous and batch machines as well as modified processes.

Reduction in waste water load: Specification of water for use in industries and its discharge to public sewage, biodegradation of chemicals. Measurement of waste water load. Preventive measures to reduce this load.

Theory of coloration of textiles: Basic approaches for application of colouring materials on various textiles, dye-fibre interaction through physical and chemical forces.

Thermodynamic study of dyeing: Study of vat dye on cotton, acid dye on wool and nylon. Dyeing equilibrium and concept of half time dyeing.

Development in chemical processing: Various developments in pre-treatments, dyeing, printing and finishing of textiles in reference to use of water, right first time dyeing and controlled application techniques.

Module-III

Process and quality control: Detailed study of chemical processing methods. Control of process parameters. Quality of raw and processed materials. Evaluation of quality of processed textiles after each processing step.

Shade reproduction and repetition: Theory and tristimulus values of colour, colour coordinates. Primary, secondary and tertiary colours. Colour yield. Analysis of shade. Preparation of shade data for reproduction.

Automation in dye house: Automation in dyeing machineries, colour rooms. On-line monitoring of concentration of dye and chemicals.

Books Recommended:

1. Bird C L and Boston W S, "The theory of coloration of textiles", Dyers Company Publication Trust, Bradford, England, 1975.
2. Manivaskaram N, "Treatment of Textile Processing Effluent", Sakthi Publications, Coimbatore, 1995.
3. Peters R H, "Textile Chemistry", Vol- III, Elsevier Scientific Publishing Co., New York, 1975,
4. Smethwurst G, "Basic water Treatment", IBT Publications, Delhi, 1989.
5. Sule A D, "Computer colour analysis", New Age International (P) Ltd., New Delhi, 1997.



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PC 2	TE6103	Chemistry of Dyes and Textile Chemicals	3	0	0	3
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Module I:

Introduction to Dye Chemistry- What is Dye? basis of colour, relation between colour and chemical constitution, colour index classification; Considerations in dye design; dye-substrate affinity, solubility & ionic groups, colour gamut; Colourant structural features, azo, anthraquinone, stilbene, thiozol, indigoid, quinacridone, quinoline, aminoketone&hydrozyketone, pthalocyanin, formazan& other dye classes.

Chemistry of dye intermediates-

Introduction- general synthesis route for e.g. primaries – dye intermediates – dyes; Importance of unit processes; important unit processes – nitration, sulphonation, halogenations, diazotisation, reduction of nitro group, preparation of selected intermediates.

Module II:

Chemistry of specific dye classes

Introduction to dye class, dye structure, common chromophores in the class, dye-fibre interaction, commercial products, impurities, standardisation, problems with generic dyes & drug room practises of anionic dyes, reactive dyes, disperse dyes, vat dyes, sulphur dyes, pigments, natural dyes, functional dyes and others.

Testing and analysis of dyes, Colour assessment & measurement: visual assessment of colour, instrumental methods, colorimetric analysis, dye identification, assessment of dyeing behaviour, computer colour matching; Evaluation & testing of dyes: standardisation & sampling, storage stability, physical forms, health & safety, in-service requirements, cost-effectiveness, dye-application properties.

Module III:

Functions and Properties of Process auxiliaries

The need for auxiliaries, the general types and characteristics of auxiliaries

Auxilliaris for Pretreatment; What is surfactant? Classification and properties, foaming and defoaming agents, Lubricating / anticreasing agents, Oligomer removers, sequestering agents, peroxide killers/ peroxide scavenger, core neutraliser, Enzymes, OBA's

Auxiliaries in Dyeing and printing- Dispersing agents, solubilising agents, thickeners, acid liberating agents, alkalies, oxidising and reducing agents, electrolytes and pH control, exhausting agents, levelling and retarding agents, migration inhibitor for continuous dyeing, carriers, dyefixing agents, clearing agents, soaps and detergents.

Ecological concerns in Textile Auxiliaries- Ecological parameters for textile chemicals, Regulatory requirements, Eco-label certification

TEXT/REFERENCE BOOKS:

1. Textile Analysis, E R Trotman and S R Trotman, Griffin, London
2. Systematic Analysis of surface Active Agents, Rosen & Goldsmith, Inter science Publisher Inc., New York,
3. Profiles in Analysis of Chemicals, N F Desai, Gokul Publishers
4. Dye house Laboratory Practices, T M Thompson, SDC
5. Evaluation of Textile Chemicals, V A Shenai and R H Mehra, Sevak Publication, Mumbai



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PE 1	TE6201	Characterization of Polymer and Fibrous Material CPFM	3	0	0	3
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Module I:

Introductory:

Basic textile polymers, thermoplastic and thermosetting polymers, Degree of polymerization and conditions that influences polymer characteristics and fibre performances, glass transition temperature. Orientation and crystallinity, Spectroscopy:

Infrared spectroscopy. Introduction, experimental techniques, Infrared spectra of natural and synthetic fibres. Identification of fibres using IR. FTIR spectroscopy. Ray diffraction and Fluorescence. Principle, working procedure of X-ray diffraction technique. X-ray diffraction of natural and synthetic fibres.

X-ray Fluorescence and its application to textile related materials. NMR and Mass Spectroscopy: Principle, working procedure and application of NMR and Mass Spectroscopy.

Module II:

Chromatographic Methods:

Theoretical considerations of chromatography. Gas chromatography – Instrumentation, qualitative analysis, quantitative analysis, theory and applications. High Pressure Liquid Chromatography – Instrumentation and applications.

Module III:

Electron Microscopy

Basic theory of electron microscopy. Imaging system, image-translating system of electron microscope. Principle, working procedure and application of scanning Electron Microscope and Transmission electron microscope.

Thermal Analysis:

Instrumentation, qualitative analysis, quantitative analysis, theory and applications of DTA, DSC, TGA.

Reference books:

1. Instrumental Methods of Analysis 7th Edition by H.H. Willard; L.L. Merritt, John A. Dean, Frank A. Settle, Jr. CBS Publishers & Distribution, Delhi.
2. Instrumental Methods of Chemical Analysis 5th Edition by Galen W. Ewing.
3. Basic Concepts of Analytical Chemistry, 2nd Edition by S.M. Khopkar
4. The Analytical Chemistry of Synthetic Dyes Edited by K. Venkataraman. Wiley-Interscience Pub. John Wiley & Sons, New York.
5. Handbook of Textile Testing Part I to 4, Bureau of Indian Standards.
6. Instrumental Analysis of Cotton Cellulose & Modified Cotton Cellulose – Robert T. O'Connor.
7. Textile Laboratory Manual – W. Garner Vol. I & II.
8. Physical Methods of Investigating Textiles – EDR. Meredith & J.W.S. Hearle.
9. Handbook of Environmental Health & Safety – Principles & Practices – Herman Koren, Michael Bisesi Vol. I & II.
10. Textile Testing & Its Role in Textile Business with Special Reference to Eco-Friendly Textiles & Eco-Testing – Dr. G.S. Nadiger & S. Subramanian.
11. Vibrational Spectroscopy Theory & Applications – D.N. Sathyanarayana.
12. Analytical Methods for a Textile Laboratory – J.W. Weaver.
13. Mass Spectroscopy – E. Constantin & A. Schanell.
14. Profiles in Analysis of Chemicals – Dr. N.F. Desai.
15. Introduction to Electron Microscopy – Saul Wischnitzer.
16. X-ray Diffraction Methods in Polymer Science – Alexander Leray E.



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PE 1	TE6203	High Performance Fibers	3	0	0	3
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MODULE I

Definition, classification and structural requirements of high performance and specialty fibres, Polymerization, spinning and properties of aramids, aromatic polyesters, rigid rod and ladder polymers such as PBZT, PBO, PBI, PIPD, Manufacture of carbon fibres from polyacrylonitrile, viscose and pitch precursors, Concept of gel spinning and spinning of UHMPE fibres, structure and properties for UHMWPE fibre. Elastomeric polymers and fibres, Lyocell fibre production.

MODULE II

Conducting fibres: Polymer conductivity, processing of conducting polymers into fibres and fibre coatings. Spinning and properties of polyaniline (PANI) fibre. Glass and ceramic fibre: manufacturing process and applications. Methods of synthesis, production and properties of: glass and ceramic fibres. Basalt fibres and their applications. Specialty fibres: profile fibres, optical fibres, bicomponent fibres and hybrid fibres, Superabsorbent polymers and fibres.

MODULE III

Polyvinyl alcohol based fibres, Ultra-fine fibres: definition, manufacturing, characteristics and applications of microdenier fibres, Specialty fibres from new polymers, hybrid fibres, nano-composite fibres, Other specialty fibres: absorbent fibres, hollow fibres and profile fibres, bi-component fibres, optical fibres.

Suggested references

1. Salem David R., Structure Formation in Polymeric Fibres, First edition, Hanser Publishers, 2000.
2. Ward I M, Developments in Oriented Polymers, Elsevier Applied Science, 1987
3. Yang H H, Kevlar aramid fiber, John Wiley & Sons, Chichester, 1993.
4. Mukhopadhyay S K, 'High-performance fibres', *Textile Progress*, 1993, 25, 1-85.
5. Ozawa S and Matsuda K, High Technology Fibers Part B, edited by Lewin M and Preston J, Marcel Dekker, New York, 1989.
6. V. K. Kothari, Textile fibres: Developments and Innovations, First edition, IAFL publications, 2000
7. Some review and research papers



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MC 1	BH6401	Mathematical Methods in Engineering	3	0	0	3
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Refer Appendix-I for detailed Syllabus.

MC 2	MS6403	Research Methodology and IPR	2	0	0	2
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Refer Appendix-I for detailed Syllabus.



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LC 1	TE6501	Evaluation of Textile Material Lab	0	0	4	2
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List of Experiments (Any 5):

1	Introduction : principles and effects of test conditions in measuring basic physical, mechanical and aesthetic properties of textile materials Standards & test methods Product specification
2	Yarn characteristics, Yarn count & twist, Yarn evenness & hairiness
3	Yarn strength, Fiber strength testing, Filament yarn stretch & bulk
4	Woven fabric construction, Fabric defects
5	Fabric tensile properties, Fabric tearing & bursting strengths
6	Seams & stitches, Seam strength, Fabric abrasion properties
7	Fabric bending, Fabric drape, Measuring hand

Reference:

- Booth J.E., "Principle of Textile Testing", Butterworth Publications, London, 1989
- Saville B.P., "Physical Testing of Textiles", Textile Institute, Manchester, 1998
- Kothari V. K., "Testing and Quality Management", Progress in Textile Technology Vol.1, IAFL Publications, New Delhi, 1999.
- Robert S Merkel, "Textile Product Serviceability by Specification", Pearson Books, 2006, ISBN: 9780023805653
- Physical testing of textiles, B. P. Saville, Woodhead
- Watson's textile design and colour Seventh Edition Edited by Z. Grosicki, Woodhead
- Chemical testing of textiles, Edited by Q. Fan, Woodhead
- Total colour management in textiles, Edited by J. Xin, Woodhead
- Fabric testing, Edited by J. L. Hu, Woodhead



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LC 2	TE6503	Textile Chemical Processing Lab-I	0	0	4	2
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List of Experiments (Any 10):

1. Desizing of cotton-acid desizing, enzyme desizing, oxidative desizing of cotton and evaluation of efficiency of desizing; iodine staining and weight loss method
2. Bleaching of Cotton by sodium hypochlorite and hydrogen peroxide; Bleaching of polyester and nylon with Sodium chlorite and hydrogen peroxide; Evaluation of efficiency of bleaching using whiteness index
3. To study dyeing of different types of reactive dyes on viscose and cotton
4. To study dyeing of acid dyes on wool and silk
5. To study dyeing of polyesters using different disperse dyes and dyeing techniques and measurement of absorbance of extracted dye.
6. Dyeing of Natural dye on wool and cotton followed by application of mordants
7. Shade matching on Cotton using Vat and Reactive Dyes
8. Direct style of printing of Reactive Dyes on cotton
9. Direct style of printing of Pigments on cotton and polyester
10. Resist style of printing – White resist under reactive dyed ground
11. Special print effect – Tie and Dye style of printing
12. Application of cross linking agent and testing of finished fabric for crease recovery angle, tensile and tear strength
13. Application of softeners and testing of finished fabric for its feel, drapability, effect on absorbency, yellowing, shade change, sewability testing, Handlometer /surface friction assessment.
14. Application of Optical brightening agent and evaluation of fabric for its whiteness.
15. Application of antibacterial agents and testing of finished fabric for antibacterial property.
16. Determination of colour fastness to various agencies like washing, light and rubbing
17. Determination of colour fastness to perspiration and bleaching agents
18. Determination of colour fastness to sublimation and hot pressing.
19. Evaluation of colour fastness to Bleach with hypochlorite and peroxide.



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AC 1	Any One from the List of AC 1 (Appendix-I)	2	0	0	0
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Refer Appendix-I for detailed Syllabus.



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2nd Semester

PC 3	TE6102	Advances in Finishing of Textiles	3	0	0	3
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Module I

Different concept and mechanism of application of chemical finishes by padding, low wet pick up and foam processing methods. Modern developments on application of textile chemical finishes.

Module II

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.

Principles, practice and chemistry of easy care, durable press, low formaldehyde and zero formaldehyde based cross-linking finishes.

Module III

Chemical finishing in relation to environmental issues. Surface and polymer treatment using Plasma and other modern technology like LBL, Sol-gel, Nanocoating

Recommended text books:

1. Thomas Vickerstaff, The physical chemistry of dyeing. Second Edition. Interscience, New York-London, 2003.
2. Hg. von Menachem Lewin und Stephen B. Sello, Handbook of fiber science and technology. Vol. II. Chemical processing of fibers and fabrics. Functional finishes: Part B. Marcel Dekker, Inc. New York/Basel, 1984
3. M. Lewin and S. B. Sello, Chemical processing of fibers and fabrics—functional finishes, Part B, Marcel Dekker, New York, 1984
4. J.T. Marsh, An Introduction to Textile Finishing, Chapman and Hall Ltd, UK (1948)
5. V.A Shenai, Technology of Textile Finishing, Sevak Publication, Mumbai
6. H. Mark, N. S. Wooding, and S. M. Atlas, Eds., Chemical aftertreatment of textiles, Wiley-Interscience Division of John Wiley and Sons, Inc., New York, 1971.,
7. W. Schinlder and P J Hauser, Chemical Finishing of Textiles, 1st Edition, Woodhead, UK, 2004.
8. Derek Heywood, Textile finishing, SDC, UK, 2003.



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PC 4	TE6104	Sustainability Issues in Textile Chemical Processing	3	0	0	3
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Module I:

Sustainability, Green Processing technologies, which require fewer chemicals, consume less energy and water and release cleaner effluent, Technologies using organic and natural fibers,

Module II:

Biocomposites, Process technologies using new enzymes, ozone, and foam technology, Low-salt reactive dyes, Combined dyeing and finishing, Industrial Hazardous Waste Management, in-plant management, reduction, recycling and disposal of waste,

Module III:

Laws related to environmental protection specially with reference to textile industry, Compliance, certification, social accountability and ethical practices.

Reference:

1. S.S Muthu (ed.) series, Textiles and Clothing Sustainability, Textile Science and Clothing Technology,
2. Environmental Aspects of Textile Dyeing - 1st Edition. Print Book & E-Book. ISBN 9781845691158, 9781845693091, Elsevier
3. Assessing the Environmental Impact of Textiles and the Clothing Supply Chain 2014, Wood Head Publication: Subramanian Senthilkannan Muthu
4. Challenges in Sustainable Wet Processing of Textiles, S.Saxena, A.S.M. Raja & A. Arputharaj, Springer, DOI 10.1007/978-981-10-2185-5_2
5. Journals, Current Issues



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PE 2	TE6202	Manufactured Fiber Technology	3	0	0	3
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Module I

Polymer rheology in shear as well as extension. Polymer entanglements. Flow instabilities in Polymer fluids. Principles of solidification. Heat and mass transfer. Melt spinning. Force and momentum balance in spinline.

Module II

Stress induced crystallization. Experimental observations from melt spinning of polyamides and polyesters. Solution spinning. Dry and wet spinning. Transport phenomena. Kinetic and thermodynamic effects in solution spinning. Solution spinning of viscose and acrylic fibres. Dry jet wet spinning. Post spinning processes. Drawing and heat setting. Stress-strain-structure relationship.

Module III

Effect of post spinning operations on fibre structure and properties. Spin finish applications. Introduction to electrospinning.

Recommended Books:

1. Billmeyer, Fred W., and Fred W. Billmeyer. Textbook of polymer science. Vol. 1984. New York: Wiley, 1984.
2. Cook, J. Gordon. Handbook of textile fibres: man-made fibres. Elsevier, 1984.
3. Lewin, Menachem. Handbook of fiber chemistry. Crc press, 2006.
4. Mishra, S. P. A text book of fibre science and technology. New Age International, 2000.
5. Gupta, V. B., and V. K. Kothari, eds. Manufactured fibre technology. Springer Science & Business Media, 2012.
6. Murthy, HV Sreenivasa. Introduction to textile fibres. WPI Publishing, 2018.
7. Moncrieff, Robert Wighton. Man Made Fibres. 1966.
8. Hearle, John WS, and William Ernest Morton. Physical properties of textile fibres. Elsevier, 2008.
9. Gowariker V R, Viswanathan N V and Sridhar J. Polymer Science, New Age International Ltd., New Delhi, 1996.
10. Vaidya, A. A. Production of synthetic fibres. Prentice-Hall of India Private Limited, 1988.
11. Meredith, Reginald. Mechanical Properties of Textile Fibres. (1956).
12. Ugbolue, S C O. Structure/property relationships in textile fibres. Textile progress 20, no. 4 (1990): 1-43.



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PE 2	TE6204	Technical Textile	3	0	0	3
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Module I:

Introduction, definition, classification, market and scope: Definition, classification, products, market overview and growth projections of technical textiles. Fibres, yarns and fabric structures in technical textiles and their relevant properties.

Geotextiles and other geosynthetics: Types and application of geosynthetics. Functions and application areas of geotextiles. Fibres and fabric selection criteria for geotextile applications. Mechanics of reinforcement, filtration and drainage by geotextiles. Soil characteristics. Methods of prediction of geotextile life and long term survivability in soil.

Module II:

Automotive Textiles: Application of textiles in automobiles. Requirement and design for pneumatic tyres, airbags and belts. Methods of production and properties of textiles used in these applications.

Protective Textiles – Protection against cold, bullets, cuts: Clothing requirements for thermal protection, ballistic protection. Extreme winter clothing with low heat transmission and comfort properties. Mechanism of high velocity impact absorption. Materials used in bullet proof and cut resistant clothing. Design for soft and hard armour. Design principles and evaluation of these protective clothing in these applications.

Theory of filtration, types and concepts, filter fabrics: Textile and other filter media for dry and wet filtration. Mechanisms of separation. Requirements for good filter media and filtration. Fibre and fabric selection for filtration.

Module III:

Agrotextiles, Architectural Fabrics, Textiles for Packaging etc.: Type and properties of fabrics used in these applications. Raw material, method of production and areas of application of agrotextiles. Different types of architectural fabrics and their property requirements. Design of temporary and permanent structures using fabrics. Different types of fabrics used for packaging. Their production techniques and properties.

Sports textiles, Fundamental Aspects of Sports Textiles, Classification, Requirements, Textile structures, Comfort and performance, Testing and Evaluation, Aerobic clothing, athletic clothing, clothing of various sports, games shorts, gloves, jackets, shorts, socks, sweatshirts, swimwear

Suggested texts and reference materials:

1. Handbook of Technical Textiles, Eds. A.R. Horrocks and S.C. Anand, Woodhead Publishing, U.K, 2000.
2. Wellington Sears Handbook of Industrial Textiles, Ed. S. Adanur, Alburn University, USA, Taylor & Francis, 1995.
3. Textiles in Automotive Engineering, Walter Fung and Mike Hardcastle, Woodhead Publishing, 2001.
4. Geotextiles, N.W.M. John, Chapman and Hall, New York, 1987.
5. Technical Textile Yarns: Industrial and Medical Applications, Edited by R. Alagirusamy and A. Das, Woodhead Publishing Ltd, 2010 in association with Textile Institute.



ODISHA UNIVERSITY OF TECHNOLOGY AND RESEARCH

Techno Campus, Mahalaxmi Vihar, Ghatikia, Bhubaneswar-751029.

Syllabus (Effective from 2023-24)

School/ Department: Department of Textile Engineering
Course: M.Tech., Programme: Textile and Chemical Processing (TCP),
Duration: 2 years (Four Semesters)

PE 3	TE6206	Application of Nano Technology in Textiles	3	0	0	3
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Module I

Introduction to Nanoscience and Nanotechnology; Size and surface dependence of their physical and chemical properties such as mechanical, thermodynamical, electronic, catalysis etc.; Synthesis of Nanomaterials used in Textiles such as carbon nanotube, fullerenes, metal and metaloxide nanoparticles i.e. nano silver, nano silica, nanotitania, nano zinc oxide, nano magnesiumoxide etc.;

Module II

Surface functionalization and Dispersion of nanomaterials; Nanotoxicity, Characterization techniques i.e. XRD, AFM, SEM/ TEM, DLS etc.; Nanomaterial applications in textiles and polymers; Nanocomposites: definition types, synthesis routes; nanocomposite fibres and coatings e.g. gas barrier, antimicrobial, conducting etc.; Nanofibres: preparation, properties and applications i.e. filtration, tissue engineering etc.; Nanofinishing: self-cleaning, antimicrobial, UV protective etc.;

Module III

Nanocoating on textile substrates: Plasma Polymerisation, Layer-by-layer Self Assembly, Sol-Gel coating etc.

Recommended Books:

1. P Brown, K Stevens, "Nanofibers and nanotechnology in Textile", WoodHead publishing.
2. A.K. Haghi, G.E. Zaikov, "Development of Nanotechnology in Textile", Nova Publishers, New York.
3. Sakka, Sumio, and Hiromitsu Kozuka, eds. Handbook of sol-gel science and technology. 1. Sol-gel processing. Vol. 1. Springer Science & Business Media, 2005.
4. Mishra Rajesh, and Jiri Militky. Nanotechnology in Textiles: Theory and Application. Woodhead Publishing, 2018.



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Syllabus (Effective from 2023-24)

School/ Department: Department of Textile Engineering
Course: M.Tech., Programme: Textile and Chemical Processing (TCP),
Duration: 2 years (Four Semesters)

PE 3	TE6208	Textile reinforced composites	3	0	0	3
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Module I: Definition, classification and materials used in composites

Definition of composites, textile composites and textile structural composites, Materials for composites, Fibre - glass, carbon, aramid, boron, ceramic and natural fibres, Matrices, classification, properties and selection of matrices, Polymer matrix, Thermoset matrix – epoxy, polyester, vinyl ester etc, Thermoplastic matrix – polyether ether ketone, polyphenylene sulphide, polysulfone, Metal matrix and Ceramic matrix, Carbon–Carbon Composites, Recycling Fiber-Reinforced Composites

Textile structures used in composites

Reinforcement structures, Classification of Textile Reinforced Structures based on axis and dimension; non-axial, mono-axial, biaxial, triaxial and multi-axial structures, UD, 2D, 3D structures, Structural anisotropy, parallel arrangement and series arrangement of components, Chopped strand and Milled fibres, Hybrid fabrics, Non-crimp fabrics, Laminates, Stitched structure, Embroidery structures, Composite Rope, Braided structures

Module II: Manufacturing Methods

Methods of composite processing, Hand and machine lay-up, spray-up moulding, vacuum-bag and pressure-bag moulding, autoclave, compression moulding, liquid resin molding, resin transfer moulding, Poltrusion, filament winding, injection moulding, thermoplastic processing, automated tape laying.

Characterization of Composites

Characterization of Composites, Mechanical Analysis, Tensile, bending, compression, impact, fatigue behavior, DMA, Thermal properties Internal Geometry of reinforcement structures, Fibre volume fraction and surface geometry, Morphological characterization of composites reinforced by various textile structures, study of fibre-matrix behaviour at interface, Damage analysis, Failure mechanisms, matrix cracking, fibre fracture, debonding, delamination, fibre pullout, micro-buckling, kink bands, Fractography, Failure criteria, Non-Destructive Testing, electromagnetic, chemical spectroscopy.

Module III: Theory of composites

Theory of composites, Composite concepts and theory, Rule of mixture, the synergy effect, Logarithmic mixing rule, Geometry of reinforcement - Particular, granular, fibrillar, lamellar, Properties of components, properties of interface, mechanism of adhesion, Fibre volume fraction calculation.

Applications of Textile structural composites

Automotives, marine, aerospace, sports, protection systems, wind energy, machine components, construction engineering

Suggested texts and reference materials:

1. Textile structural composites by Tsu Wei Chou and Frank K. Ko, ELSEVIER, 1989
2. 3D Fibrous assemblies, by Jinlian Hu, WOODHEAD, 2009
3. High performance fibre composites, by J G Morley, Harcourt Brace Jovanovich, 1987
4. Textile structural composites, by S Advani, Conference proceedings, 2007
5. Design and Manufacturing of Textile structural composites by A Long, WOODHEAD

Books Recommended

1. Fibre reinforced composites by P.K.Mallick CRC press.
2. HANDBOOK OF TECHNICAL TEXTILES Edited by A R Horrocks and S C Anand.



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Course: M.Tech., Programme: Textile and Chemical Processing (TCP),
Duration: 2 years (Four Semesters)

OE 1	Any One from the List of OE 1 (Appendix-I)	3	0	0	3
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Refer Appendix-I for detailed Syllabus.



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Syllabus (Effective from 2023-24)

School/ Department: Department of Textile Engineering
Course: M.Tech., Programme: Textile and Chemical Processing (TCP),
Duration: 2 years (Four Semesters)

PR 1	TE6602	Project (Specialization Related)	0	0	4	2
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Duration: 2 years (Four Semesters)

LC 3	TE6502	Textile Chemical Processing and Evaluation Lab-II	0	0	4	2
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List of Experiments:

1. Absorption and transmission measurement, Lambda **Max** by UV Vis Spectrophotometer
2. Lambert-Beer's law, Dye strength determination, Dye exhaustion calculation.
3. Measurement & Interpreting fabric reflectance and K/S results.
4. Measurement of light fastness of reactive & direct dye.
5. Measurement of wash fastness
6. Rubbing fastness.
7. Perspiration fastness
8. Evaluation of Dyed samples and interpreting CIE L*a*b* **results, DE, Whiteness** Yellowness index.
9. Experimenting with colorimeter, Pantone shade
10. Color vision/blindness, Eye color testing, Light sources, Irradiance
11. Colorfastness tests
12. Effluent **testing: BOD, COD,**
13. Effluent **testing: TDS, TSS**
14. Determination of cellulose **decomposition,**
15. Antimicrobial Test
16. HLB Value
17. Formaldehyde Content



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Course: M.Tech., Programme: Textile and Chemical Processing (TCP),
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AC 2	Any One from the List of AC 2 (Appendix-I)	2	0	0	0
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Refer Appendix-I for detailed Syllabus.



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Syllabus (Effective from 2023-24)

School/ Department: Department of Textile Engineering
Course: M.Tech., Programme: Textile and Chemical Processing (TCP),
Duration: 2 years (Four Semesters)

3rd Semester

PE 4	TE7201	Process Control in Textiles Wet Processing	3	0	0	3
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Module I: Introductory:

Introduction to textile chemical testing – aim and scope. Quantitative chemical analysis of textile fibres and their blends, Process control flow chart and control measures in each.

Module II: Preparatory: Quantitative estimation of bleaching agents (hypochlorite, chlorite and peroxide) and dyes. Test of Desizing, scouring, mercerization. Estimation of mechanical and chemical degradation of cotton, wool, silk and polyester (aldehyde and carboxyl group estimation in cellulose, amino group, estimation of protein fibres, fluidity/viscosity measurement, critical dissolution time

Dyeing: Colour fastness of dyes on textiles (wash, light, rubbing, hot press, perspiration, etc). International standards (AATCC, ISO, ASTM, BIS)

Module III: Auxiliaries, Finishing & Printing:

Evaluation of various chemicals, auxiliaries used in wet processing plants. Methods of evaluation of various finishes on textile material. Measurement of viscosity of chemical ingredients, printing paste, instruments used in chemical analysis.

TEXT BOOKS

1. Analytical Methods for a Textile laboratory, JW Weaver
2. Technology of Textile Processing, VA Shenai
3. An Introduction to Textile Bleaching, JT Marsh
4. AATCC Technical Manual Vol.-76,
5. Chemical Testing of Textiles, QinguoFan, CRC Woodhead
6. Textile Processing and Properties: Preparation, Dyeing, Finishing and performance, T.L. Vigo, ELSEVIER
7. Chemical Technology in the Pre Treatment Processes of Textiles, S.R.Karmakar, ELSEVIER
8. Process Control in Textile Manufacturing, A Majumdar, A. Das, R Alagirusamy, V K Kothari, Woodhead



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School/ Department: Department of Textile Engineering
Course: M.Tech., Programme: Textile and Chemical Processing (TCP),
Duration: 2 years (Four Semesters)

PE 4	TE7203	Biotechnology in Textiles	3	0	0	3
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Module-I

Enzyme engineering: Isolation and purification of enzymes; immobilization of enzymes: enzyme engineering; synzymes; Uses of enzymes in textile industries. Developments in singeing, desizing and its eco-aspects, size recovery, bleaching and its eco-aspects, classification of enzymes, Mode of action of enzyme, Factors affecting efficiency of enzyme treatment. Enzyme retted flax using different formulations, influence of enzymatic pretreatment on the colours of bleached and dyed flax fibers, combined bioscouring and bleaching of cotton fibers, effect of ultrasound on the performance of industrial enzymes used in cotton bio-preparation/bio-finishing applications, Enzymatic degumming, enzymatic H₂O₂ bleaching.

Module-II

Biotechnology in retting of jute, Deterioration of textiles, painted surfaces, and their prevention. Use of enzymes in detergents. Dyes from microorganisms, naphthoquinone dye, antraquinone dye, indigo dye. Textile in waste water treatment, biofilters and bioscrubbers, Fungi in decolouration, degradation of azo dye by *P. chrsosporium*, Gram negative bacteria degrading dye stuffs. Natural fiber improvement, biobasedfibre (biopolymers), chemical process substitutions, New textiles with antimicrobial properties, biofinishing, improvement of texture and of cotton. Herbal softner for textile

Module-III

Microorganisms and their enzymes in bioprocessing, cellulose, amylase, pectinase, catalase, laccases, lipases, peroxidases. Biofabric, biotech production of natural fiber, modification of properties of textile, production new polymeric natural, polyamides (i.e. protein polymers) and polysters(production of biopolysters). Bacterial cellulose and polysaccharides viz., chitin, alginate, dextran and hyluronic acid, Transgenic cotton

References.

1. Biotechnology in Textile processing, by Georg M. Guebitz, ArturCavaco-paulo, Ryszard Kozlowski, The Hawarth Press, Inc.
2. Biotechnology in Textile byRyszard Kozlowski, Georg M. Guebitz, ArturCavaco-Paulo ISBN:/9781560221432, CRC Press
3. Journals



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School/ Department: Department of Textile Engineering
Course: M.Tech., Programme: Textile and Chemical Processing (TCP),
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PR 2	TE7601	Dissertation (Phase-I)	0	0	24	12
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Course: M.Tech., Programme: Textile and Chemical Processing (TCP),
Duration: 2 years (Four Semesters)

4th Semester

PR 3	TE7602	Dissertation (Phase-II)	0	0	32	16
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