

FACULTY OF SCIENCES

SYLLABUS

for

B. TECH (TEXTILE CHEMISTRY) (Under Credit Based Continuous Evaluation Grading System) (SEMESTER: I-VIII)

Session: 2013-14



GURU NANAK DEV UNIVERSITY

AMRITSAR

**Note: (i) Copy rights are reserved.
Nobody is allowed to print it in any form.
Defaulters will be prosecuted.**

**(ii) Subject to change in the syllabi at any time.
Please visit the University website time to time.**

B. TECH. (TEXTILE CHEMISTRY) SEMESTER SYSTEM
(Under Credit Based Continuous Evaluation Grading System)

**SCHEME
SEMESTER – I**

Course Code	Subject	Course Type	Credits	L	T	P
TCL-101	Chemistry of Colorants	C	4	3	1	0
STL-102	Manufacturing Processes	C	4	3	1	0
ECL-210	Basic Electrical and Electronic Engg.	C	4	3	1	0
PBL-121	Punjabi Compulsory-I OR	C	2	2	0	0
PBL-122	Basic Punjabi (Mudhli Punjabi)	C	2	2	0	0
ENL-101	Communicative English – I	C	2	2	0	0
TCL-001	Introduction to Textiles* / Interdisciplinary Course – I	ID	4	3	1	0
TCP-101	Dye Chemistry Lab	C	2	0	0	2
STP-102	Manufacturing Process Workshop	C	2	0	0	2

SEMESTER – II

Course Code	Subject	Course Type	Credits	L	T	P
TCL-102	Textile Engineering	C	4	3	1	0
TCL-103	Colour Science	C	4	3	1	0
PBL-131	Punjabi Compulsory-II OR	C	2	2	0	0
PBL-132	Basic Punjabi (Mudhli Punjabi)	C	2	2	0	0
ENL-151	Communicative English – II	C	2	2	0	0
MTL-122	Applied Maths	C	4	3	1	0
TCL-002	Textile Care* / Interdisciplinary Course – II	ID	4	3	1	0
TCP-102	Textile Testing Lab (Chemical)	C	3	0	0	3
STP-104	Design and Drawing Lab.	C	2	0	0	2
*Interdisciplinary course for other Departments.						

B. TECH. (TEXTILE CHEMISTRY) SEMESTER SYSTEM
(Under Credit Based Continuous Evaluation Grading System)

SEMESTER – III

Course Code	Subject	Course Type	Credits	L	T	P
TCL-201	Cellulosic Dyeing Tech	C	4	3	1	0
TCL-202	Pretreatment Technology –I	C	4	3	1	0
TCL-203	Fibre Science	C	4	3	1	0
ESL-220	Environmental Studies (Compulsory)		3	3	0	0
TCL-204	Textile Testing-I	C	4	3	1	0
TCP-201	Cellulosic Dyeing Lab	C	3	0	0	3
TCP-202	Pretreatment Lab	C	3	0	0	3
For only qualifying marks not to be included in Grand Total.						
Note: Credits will not be included in SGPA.						

C: Core Course, ID: Interdisciplinary Course, EL: Departmental Elective Course

SEMESTER – IV

Course Code	Subject	Course Type	Credits	L	T	P
TCL-205	Wool Dyeing Technology	C	4	3	1	0
TCL-206	Pretreatment Tech – II	C	4	3	1	0
<i>TCL-207♠</i>	<i>Physical Properties of Textile Fibres</i>	<i>EL</i>	<i>3</i>	<i>3</i>	<i>0</i>	<i>0</i>
<i>MTL-222♠</i>	<i>Applied Stat & Statistical Control</i>	<i>EL</i>	<i>3</i>	<i>3</i>	<i>0</i>	<i>0</i>
TCL-208	Introduction to Yarn Manufacture	C	4	3	1	0
	Interdisciplinary Course – III	ID	3	3	0	0
	Interdisciplinary Course – IV	ID	3	3	0	0
TCP-203	Wool Dyeing Lab	C	3	0	0	3
TCP-204	Textile Testing Lab (Physical)	C	3	0	0	3
♠ Elective Course: To select any one						

B. TECH. (TEXTILE CHEMISTRY) SEMESTER SYSTEM
(Under Credit Based Continuous Evaluation Grading System)

SEMESTER – V

Course Code	Subject	Course Type	Credits	L	T	P
TCL-301	Synthetic Dyeing Technology	C	4	3	1	0
TCL-302	Printing Technology – I	C	4	3	1	0
TCL-303	Finishing Technology – I	C	4	3	1	0
TCL-304	Textile Testing – II	C	4	3	1	0
TCL-305	Introduction to Fabric Manufacture	C	4	3	1	0
TCP-301	Synthetic Dyeing Lab	C	3	0	0	3
TCP-302	Printing Lab – I	C	2	0	0	2
TCP-303	CCM – Lab	C	3	0	0	3

SEMESTER – VI

Course Code	Subject	Course Type	Credits	L	T	P
TCL-306	Blends Dyeing Technology	C	3	3	0	0
TCL-307	Printing Technology – II	C	3	3	0	0
TCL-308	Finishing Technology – II	C	3	3	0	0
TCL-309	Quality and Process Control in Textile Wet Processing	C	3	3	0	0
<i>TCL-310 ♠</i>	<i>Hi-tech Application of Dyes</i>	<i>EL</i>	<i>3</i>	<i>3</i>	<i>0</i>	<i>0</i>
<i>TCL-311 ♠</i>	<i>Textile Testing Standards/Regulations</i>	<i>EL</i>	<i>3</i>	<i>3</i>	<i>0</i>	<i>0</i>
<i>TCL-312 ♠</i>	<i>Recent Trends in Printing & Garment Processing</i>	<i>EL</i>	<i>3</i>	<i>3</i>	<i>0</i>	<i>0</i>
<i>TCL-313 ♠</i>	<i>Bio-Processing of Textiles</i>	<i>EL</i>	<i>3</i>	<i>3</i>	<i>0</i>	<i>0</i>
<i>TCL-314 ♠</i>	<i>Technical Textiles</i>	<i>EL</i>	<i>3</i>	<i>3</i>	<i>0</i>	<i>0</i>
	Interdisciplinary Course – V	ID	3	3	0	0
	Interdisciplinary Course – VI	ID	3	3	0	0
TCP-304	Blends Dyeing Lab	C	3	0	0	3
TCP-305	Printing Lab – II	C	2	0	0	2
TCP-306	Finishing Lab	C	2	0	0	2
TCE-301	Industrial Training	C	6	0	0	6
TCD-301	Research Project*	C	2	0	0	2
♠ Elective Course: To select any one						
* Evaluation of Literature Survey.						

B. TECH. (TEXTILE CHEMISTRY) SEMESTER SYSTEM
(Under Credit Based Continuous Evaluation Grading System)

SEMESTER – VII

Course Code	Subject	Course Type	Credits	L	T	P
TCL-401	Business and Financial Management	C	4	3	1	0
TCL-402	Waste Management in Textile Industry	C	4	3	1	0
TCL-403	Garment Manufacturing & Processing Technology	C	4	3	1	0
	Interdisciplinary Course – VII	ID	3	3	0	0
	Interdisciplinary Course – VIII	ID	3	3	0	0
TCS-401	Seminar	C	4	0	0	0
TCD-401	Research Project	C	4	0	0	4

SEMESTER – VIII

Course Code	Subject	Course Type	Credits	L	T	P
TCD-402	Research Project	C	4	0	0	4
TCE-401	Industrial Training (4 Months)	C	16	0	0	16

B. TECH. (TEXTILE CHEMISTRY) SEMESTER-I
(Under Credit Based Continuous Evaluation Grading System)

TCL-101

CHEMISTRY OF COLORANTS**Credits: 3-1-0****UNIT – I****Part A: Chemistry of Pigments:**

General discussion about pigments, types of pigments, details of conversion of dyes into pigments by using various methods such as: Dyes made insoluble by precipitation on substrates, dyes made insoluble by precipitation with complex acids, conversion of vat dyes into pigments, some key examples. Metal free azo pigments derived from: 2-naphthols, acetoacetanilides, BON acid derivatives, azo condensation pigments. metal containing azo pigments (Group 2a): rosination process, pigments made from azo dyes (Group 2b), Pigments made from benzimidazolones and pyrazolones. Phthalocyanine pigments: manufacture of crude blue using dry bake and solvent processes, mechanism of their formation, conversion of crude blue into copper phthalocyanine. Thermodynamically stable forms of crude blue, -form and -form, conversion of crude blue in - and - forms. Inorganic pigments: titanium dioxide, ultramarine, cadmium pigments, iron oxide pigments, general discussion with examples. (10)

Part B: Classifications of Dyes:

Introduction about colour index classification, colour and chemical constitution. Application classes of dyes such as acid dyes, basic dyes, direct dyes, disperse dyes, reactive dyes, vat dyes, sulphur dyes, azoic dyes, mordant dyes, metal complex dyes etc. Forces responsible for dye-fibre interaction in each dye class. Chemical classes of dyes such as azo class, anthraquinone class, indigoid class, thiazole dyes, stilbene dyes, fluorescent brightening agents, quinacridone colorants, quinophthalone dyes, phthalocyanine, formazan colorants, cyanine dyes, diarylmethane, triarylmethane dyes, xanthine dyes, acridine dyes, oxazine, thiazine and azine, dioxazine dyes etc. (5)

UNIT – II**Part C: Dye Structure, Technical Evaluation and Application Properties:**

Forces responsible for dye fixation on fibres, dye-bath interactions. Dye aggregation concept and correlation of dye structure with aggregation number, decomposition of water soluble dyes during dyeing, rates of reduction and redox potentials of vat dyes, dispersion properties and aqueous solubility of disperse dyes. Dyeability of fibres in relation to dye structure: dyeing of cellulosic fibres with anionic dyes, dyeing of amide fibres with anionic dyes, dyeing of ester fibres with disperse dyes, dyeing of acrylic fibres with basic dyes. Application properties and chemical structure: dyeing kinetics and dye structure, dye structure and affinity for the fibre, effect of dye structure on diffusion coefficient, migration and leveling, light fastness and wet fastness. (10)

UNIT – III

Part D: Chemistry of Colorants:

(i) Chemistry of Azo Colorants:

Introduction, mechanisms of diazotisation and coupling, diazotisation methods viz., direct and indirect methods, Use of nitrosyl sulphuric acid, preparation and use of coupling components viz., acetoacetarylamides, pyridones, pyrazolones, aminopyrazoles, phenols, aniline derivatives, aminophenols, naphthols, maphthylamines and amino naphthols. Structure of azo dyes viz. stereochemical isomerism and tautomerism. Schematic representation of azo dyes (Winthor symbols), examples of azo dyes e.g., sulphonated azo dyes viz. acid dyes for wool and nylon, direct dyes, unsulphonated azo dyes viz. solvent dyes, disperse dyes. Basic azo dyes, azoic diazo and coupling components, stabilised diazonium salts and azoic compositions, rapid fast colours, rapidogenes and neutrogenes. (5)

(ii) Chemistry of Anthraquinonoid, Polycyclic, Indigoid and Miscellaneous Colorants:

Anthraquinonoid system based dyes out of various categories such as: acid, basic, disperse and reactive dyes with examples. Polycyclic vat dyes based on: anthraquinone systems, indanthrones, benzantrones, carbazoles, acridones and other miscellaneous polycyclic systems, their representative examples with structures (no synthesis). Indigoid and thioindigoid dyes, Sulphur and thiazole dyes: structural features. Diarylmethane and triarylmethane dyes: difference of colour in these two classes, their use in various dye classes. Dyes based on nitro, nitroso, xanthene, acridine, azine, oxazine, thiazine and polymethine systems: their examples. (15)

Text:

1. Colorants and Auxiliaries, Volume –I Edited by John Shore, The Society of Dyers and Colorists (SDC), UK.

B. TECH. (TEXTILE CHEMISTRY) SEMESTER-I
(Under Credit Based Continuous Evaluation Grading System)

STL-102

MANUFACTURING PROCESSES

Credits: 3-1-0

UNIT – I

1. **Plastics and their Processing:** Introduction, Types of Plastics, Thermo-plastics, Materials for processing plastics, Moulding processes compression moulding, Transfer Moulding, Injection moulding, Extrusion, Calendering, Thermo forming, Blow moulding, Casting, Laminating & Reinforcing, foamed plastics, Fastening & machine plastics.
2. **Ferrous Metal & Alloys:** Introduction, Pig iron, cast iron, wrought iron, carbon steel, alloy steel, blast furnace, modern development, electric furnace process, classification of steel, unalloyed steels and alloy steels.
3. **Non-Ferrous Metals & Alloys:** Introduction, Aluminum & its alloys, copper and its alloys, lead and its alloys, phosphors Bronze gun metal.
4. **Joint Processes:** Introduction, weldability, types of welding, welding processes, use of electricity in welding, formation & characteristics of electric Arc, Four positions of Arc, welding, types of joints and types of applicable welds, Arc. Welding machine. TIG welding MIG welding, submerged welding, laser welding, spot welding etc. gas welding, Oxyacetylene welding, types of gas flame welding equipments, relative merits of AC & DC welding, welding defects, soldering and Brazing. Welding technique for Pipes.

UNIT – II

5. **Carpentry:** Introduction, structure of wood, grain in wood, seasoning of wood, classification of wood, common varieties of Indian timber, carpentry tools, marking and measuring tools, cutting tools, boring tools, striking tools, holding tools, miscellaneous tools, carpentry processes marking, sawing, planing, chiseling, boring, grooving, rebating, moulding, carpentry joints, wood working lathe, circular saw, band saw, wood planer, joint, mortiser.
6. **Foundry:** Introduction, pattern making pattern materials, types of pattern, solid pattern, split pattern, match plate pattern, three piece split pattern, etc. Pattern making allowances moulding tools and equipments. Moulding sand, types of moulding sands, properties of moulding sand casting defects.
7. **Mechanical Working of Metals (Metal Forming):** Introduction, hot working, rolling, forging, piercing, Drawing, Spinning, extruding, cold working, metallurgical advantages of hot working over cold working processes.

B. TECH. (TEXTILE CHEMISTRY) SEMESTER-I
(Under Credit Based Continuous Evaluation Grading System)

UNIT-III

8. **Machine Process:** Introduction, function of the lathe, types of lathe, speed lathe, engine lathe, bench lathe, tool room lathe, capstan and turret lathe, special purpose lathe, automatic lathe, size of lathe, list of lathe operations. Difference between Capstan & Turret & an Engine lathe.
9. **Drilling Machine:** Introduction, types of drilling machine, work holding devices, list of drilling machine operation, twist drill nomenclature.
10. **Shaper and Planning Machines:** Introduction, types of shaper and planner, list of shaper and planer operations, Planner vs shaper machine.
11. **Grinding Machines:** Introduction, kinds of grinding, types of grinding machines, rough grinding and precision grinding, portable and flexible shaft grinders, swing frame grinders, surface grinders etc. size and capacities of the grinder.

Text:

1. Workshop Technology by Hazra Chaudhary, Latest Edition, Volumes I,II.
2. Workshop Technology by W.A.J. Chapman, Part I & II.

B. TECH. (TEXTILE CHEMISTRY) SEMESTER-I
(Under Credit Based Continuous Evaluation Grading System)

ECL-210 BASIC ELECTRICAL & ELECTRONICS ENGINEERING

Credits: 3-1-0

Note: Students can use the non-programmable scientific calculator.

UNIT-I

1. **Electric current and ohm/s law:** Ohm's law, resistances in series, resistances in parallel, division of current in parallel circuits, equivalent resistance, numericals.
2. **Network theorems:** Kirchhoff's laws, Thevenin theorem, work, power & energy, effect of electric current, Joule's law of electric heating, numericals.
3. **Electromagnetic Induction & A.C. Fundamentals:** Faraday's law of electromagnetic induction, Generation of alternating voltage, current, simple wave form, cycle time period, frequency, amplitude, phase, phase difference.
4. **Transformer:** working principle of a transformer construction, elementary theory of an ideal transformer, E.F. equation of a transformer, voltage transformation, ration efficiency of a transformer, three phase transformer.

UNIT-II

5. **Induction Motor:** Classification of A.C. motors, general principle construction, relation between torque & slip, control of A.C. motors.
6. **D.C. Generators & D.C. Motors:** Generator principle, construction & working of generator, motor principle, comparison of generator & motor action, comparison of shunt, series motors, losses & efficiency power stages, speed control of D.C. motors.

UNIT-III

7. **Electronic Devices:** Semiconductors, bipolar junction transistor, transistor circuit configuration transistor characteristics, Field-effect transistors.
8. **Amplifiers:** Classification, configuration, concept of feedback amplifiers.
9. **Special Diodes:** Zener diode, voltage regulation.
10. **Cathode Ray Oscilloscope (CRO):** Introduction, analog & digital instruments, function of instruments, electronic versus electrical instruments.

Texts:

1. Fundamentals of Electrical Engg. & Electronics.
2. Principles of Electrical Engg. by Vincent Del Tora.
3. Basic Electronics by G.K. Mittal.
4. Electronic Principles by A.P. Malvino.

PBL-122: ਮੁੱਢਲੀ ਪੰਜਾਬੀ
(In lieu of Punjabi Compulsory)

2-0-0

ਪਾਠ-ਕ੍ਰਮ

1. ਪੰਜਾਬੀ ਭਾਸ਼ਾ,
ਗੁਰਮੁਖੀ ਲਿਪੀ
ਗੁਰਮੁਖੀ ਲਿਪੀ : ਬਣਤਰ ਅਤੇ ਤਰਤੀਬ
2. ਗੁਰਮੁਖੀ ਆਰਥੋਗ੍ਰਾਫੀ
ਸੂਰ ਬਣਤਰ ਅਤੇ ਉਚਾਰਨ
ਵਿਅੰਜਨ ਬਣਤਰ ਅਤੇ ਉਚਾਰਨ
3. ਪੰਜਾਬੀ ਸ਼ਬਦ ਬਣਤਰ
ਸਾਧਾਰਨ ਸ਼ਬਦ
ਇਕ ਉਚਾਰਖੰਡੀ ਸ਼ਬਦ

ਯੂਨਿਟ ਅਤੇ ਥੀਮ

1. ਪੰਜਾਬੀ ਭਾਸ਼ਾ : ਨਾਮਕਰਣ ਅਤੇ ਸੰਖੇਪ ਜਾਣ ਪਛਾਣ, ਗੁਰਮੁਖੀ ਲਿਪੀ : ਨਾਮਕਰਣ, ਗੁਰਮੁਖੀ ਵਰਣਮਾਲਾ; ਪੈਂਤੀ ਅੱਖਰੀ, ਅੱਖਰ ਕ੍ਰਮ, ਸੂਰ ਵਾਹਕ (ੳ ਅ ਏ), ਲਗਾਂ ਮਾਤਰਾਂ, ਪੈਰ ਵਿਚ ਬਿੰਦੀ ਵਾਲੇ ਵਰਣ, ਪੈਰ ਵਿਚ ਪੈਣ ਵਾਲੇ ਵਰਣ, ਬਿੰਦੀ, ਟਿੱਪੀ, ਅੱਧਕ।
2. ਗੁਰਮੁਖੀ ਆਰਥੋਗ੍ਰਾਫੀ ਅਤੇ ਉਚਾਰਨ; ਸੂਰਾਂ ਦੀ ਬਣਤਰ ਅਤੇ ਉਚਾਰਨ (ਲਘੂ-ਦੀਰਘ ਸੂਰ); ਸੂਰ ਅਤੇ ਲਗਾਂ ਮਾਤਰਾਂ; ਵਿਅੰਜਨਾਂ ਦੀ ਬਣਤਰ ਅਤੇ ਉਚਾਰਨ; ਪੈਰ ਵਿਚ ਪੈਣ ਵਾਲੇ ਵਰਣਾਂ (ਹ, ਰ, ਵ) ਦਾ ਉਚਾਰਨ ; ਲ ਅਤੇ ਲ ਦਾ ਉਚਾਰਨ; ਭ, ਧ, ਢ, ਝ, ਞ ਦਾ ਉਚਾਰਨ; ਪੈਰ ਵਿਚ ਬਿੰਦੀ ਵਾਲੇ ਵਰਣਾਂ ਦਾ ਉਚਾਰਨ।
3. ਪੰਜਾਬੀ ਸ਼ਬਦ-ਬਣਤਰ : ਸਾਧਾਰਨ ਸ਼ਬਦ; ਇਕੱਲਾ ਸੂਰ (ਜਿਵੇਂ ਆ); ਸੂਰ ਅਤੇ ਵਿਅੰਜਨ (ਜਿਵੇਂ ਆਰ); ਵਿਅੰਜਨ ਅਤੇ ਸੂਰ (ਜਿਵੇਂ ਪਾ); ਵਿਅੰਜਨ ਸੂਰ ਵਿਅੰਜਨ (ਜਿਵੇਂ ਪਾਰ); ਕੋਸ਼ਗਤ ਸ਼ਬਦ (ਜਿਵੇਂ ਘਰ, ਪੀ); ਵਿਆਕਰਣਕ ਸ਼ਬਦ (ਜਿਵੇਂ ਨੂੰ, ਨੇ); ਪੰਜਾਬੀ ਸ਼ਬਦ ਰਚਨਾ-1; ਲਿੰਗ-ਪੁਲਿੰਗ, ਇਕ ਵਚਨ-ਬਹੁ ਵਚਨ; ਨਿੱਤ ਵਰਤੋਂ ਦੀ ਪੰਜਾਬੀ ਸ਼ਬਦਾਵਲੀ-1: ਖਾਣ-ਪੀਣ, ਸਾਕਾਦਾਰੀ, ਰੁੱਤਾਂ, ਮਹੀਨਿਆਂ, ਗਿਣਤੀ, ਮੌਸਮ ਆਦਿ ਨਾਲ ਸੰਬੰਧਿਤ।

B. TECH. (TEXTILE CHEMISTRY) SEMESTER-I
(Under Credit Based Continuous Evaluation Grading System)

Subject Code: ENL-101

Duration of Examination: 3 Hrs

Course Title: **Communicative English-I**

Credits: 02 (L=2,T=0,U=0)

Objectives: To Introduce students in a graded manner to the communication skills of Reading and Writing in English. At the end of semester I, the students should be able to demonstrate adequate competence in comprehending the prescribed text and performing the given writing tasks.

Reading:

a) Developing Habits of Independent and Fast Reading:

Students will be required to read a prescribed prose anthology titled *Selections from Modern English Prose* (Ed. Haladhar Panda published by University Press, Hyderabad). The essays in the anthology will be read by students at home with the help of glossary given in the book. Progressing from one lesson to another, they should learn to read fast.

Students are supposed to keep a record of their reading in the form of notes, difficulties, summaries, outlines and reading time for each essay. Class teacher may use this record for award of internal assessment (if any).

b) Developing Comprehension Skills:

Teacher will provide guided comprehension of the prescribed texts in the class and help students in answering the questions given at the end of each lesson. Teacher can construct more questions of factual and inferential nature to enhance the comprehension skills of the students. The teacher shall also guide students to do the grammar exercises given at the end of each lesson.

Writing:

a) Developing Skills in Personal Writing:

Students will be required to learn short personal write-ups involving skills of description and narration. The types of composition task may include personal letter writing, telegram writing, notice writing, diary writing etc. Teacher shall instruct the students about the appropriate format and usual conventions followed in such writings. The teacher may also prescribe composition/writing book if so required.

b) Developing Writing Skills based on Guided Composition:

The students will be required to write a longish composition on a question from the essays on *Selections from Modern English Prose*. The composition will require presentation of ideas beyond the prescribed essays. Sample composition topics are given at the end of each lesson.

B. TECH. (TEXTILE CHEMISTRY) SEMESTER-I
(Under Credit Based Continuous Evaluation Grading System)

Question Paper: The following format is suggested for a 3–hour test.

(Appropriate choices may be given where possible)

1. Short–answer comprehension questions (at least 5) based on the lessons included in *Selection from Modern English Prose* **App. weighting 30%**
2. Questions on grammar and vocabulary (words, phrases, proverbs) **App. weighting 20%**
3. Two short writing tasks of app. 100 words. One a personal letter involving narration of a personal experience or description of objects, persons, places of events. The second may be a telegram or public notice or a diary entry about a personal or family achievement, loss or celebration. **App. weighting 30%**
4. One long composition of about 300 words on one of the topics discussed in Selections from Modern English Prose. Due consideration be given to the organization of details and coherence in writing. **App. weighting 20%**

Internal Assessment: The teacher may consider the following for award of internal assessment, if any.

1. Evidence of independent reading as given above. Teacher may suggest some special tasks to suit the needs of their students.
2. Students may be asked to keep diary of their daily or specific routines.
3. Students may be asked to write a certain number of compositions on selected topics during the semester.

The division of the syllabus and the paper pattern for Minor and Major tests may be as follows:-

Minor-I

The syllabus to be covered; the essay from Sr. No. 1 to Sr. No. 6 from the prescribed book and personal letter.

Paper pattern: The following format is suggested for a test of 20 marks.

1. Personal letter (1 out of 2)
2. Short answer type question from the essay (2 out of 4).
3. Questions on Grammar and Vocabulary.

B. TECH. (TEXTILE CHEMISTRY) SEMESTER-I
(Under Credit Based Continuous Evaluation Grading System)

Minor-II

The syllabus to be covered; the essay from Sr. No. 7 to Sr. No. 13 from the prescribed book and personal letter.

Paper pattern: The following format is suggested for a test of 20 marks.

1. Personal letter (1 out of 2)
2. Short answer type question from the essay (2 out of 4).
3. Questions on Grammar and Vocabulary.

Major Test

The syllabus to be covered; the essay from Sr. No. 14 to Sr. No. 20 from the prescribed book telegram and diary entry.

The format for 3 hour major test will be mentioned in the syllabus. This test will also include the syllabus covered in Minor-I and Minor-II.

B. TECH. (TEXTILE CHEMISTRY) SEMESTER-I
(Under Credit Based Continuous Evaluation Grading System)

TCL-001 Introduction to Textiles*/Interdisciplinary Course- I

Credits: 3-1-0

*** Introduction to Textiles:** Interdisciplinary course for other departments.

Note: Interdisciplinary Course I: Students of B.Tech Textile Chemistry has to select a interdisciplinary course floated by other departments

B. TECH. (TEXTILE CHEMISTRY) SEMESTER-I
(Under Credit Based Continuous Evaluation Grading System)

TCP-101

DYE CHEMISTRY LAB

Credits: 0-0-2

- 1. Introduction to simple laboratory techniques used in dye intermediate-dyestuff industry:**
Crystallization, Distillation, Vacuum distillation, extraction, Chromatography (TLC and Preparative), determination of R_f values.
- 2. Identification of dye-intermediates bearing the following functional groups:**
Preliminary identification, Detection of elements e.g., N, S and halogens, identification and confirmation of functional groups such as: carboxylic acids, nitro group, aldehyde, ketene, ester, amide, unsaturation, alcohols, phenols, sulphonic acids, ammonium salts, quinines, amines, ethers, halogen compounds.
- 3. Demonstration of simple unit operations used in dyestuff industry such as:**
Acetylation: Preparation of Acetanilide.
Nitration: Nitration of acetanilide.
Esterification: Preparation of methyl benzoate (Oil of Noibe).
Bromination: Preparation of p-bromoacetanilide from acetanilide.
Diazotization and Coupling: Preparation of 1-Phenylazo-2-naphthol (Sudan 1).

Texts:

1. Practical Organic Chemistry by F. G. Mann and B. C. Saunders. The English Language Book Society (1970).
2. Vogel's Textbook of Practical Organic Chemistry, 1996, Fifth Edition, ELBS, UK.
3. Techniques and Experiments for Organic Chemistry by Addison Ault, 1998, Sixth Edition, University Science Books, California.

B. TECH. (TEXTILE CHEMISTRY) SEMESTER-I
(Under Credit Based Continuous Evaluation Grading System)

STP – 102 MANUFACTURING PROCESSES WORKSHOP

Credit: 0-0-2

MACHINE SHOP (4 periods)

Machine shop practice on Lathe, Milling Machine and shaper simple jobs.

CARPENTRY SHOP (4 periods)

Simple jobs on sawing, ripping, planing and chiseling, wood turning practice in carpentry shop.

FITTING SHOP (2 periods)

Simple jobs on fitting, sawing, tapping and dieing practice in fitting shop.

SHEET METAL SHOP (1 period)

Cutting and joining of sheet metal jobs, simple cylindrical jobs. Practice in sheet metal-shop.

SMITHY SHOP (1 period)

Simple jobs practice in smithy shop.

WELDING SHOP (4 periods)

Fillet joint welding and corner joint welding practice in welding shop.

ELECTRICAL SHOP (4 periods)

Single switch wiring for household and winding of coils practice in electrical shop.

Texts:

1. Workshop Technology by Hazra Chaudhary Latest Edition Volumes I,II
2. Workshop Technology by Chapman.

B. TECH. (TEXTILE CHEMISTRY) SEMESTER-II
(Under Credit Based Continuous Evaluation Grading System)

TCL -102

TEXTILE ENGINEERING

Credits: 3-1-0

UNIT – I

1. Fuels and Combustion: Introduction, solid, liquid and gaseous fuels, merits and demerits of liquid fuel over solid fuel and gaseous fuel, requirements of a good fuel, calorific values of fuel, GCV and NCV, flue gas analysis by volume Orsat apparatus, Dulong formula, determination of the weight of dry flue gases per kg of fuel, minimum air required per kg of fuel, excess air, numerical.
2. Boilers: Introduction, essentials of a good steam boiler, selection of a steam boiler, classification of boilers, fire and water tube type, vertical tubular boiler, high pressure boiler, typically high pressure boiler, comparison between water tube and fire tube boiler, mounting and accessories.
3. Steam: Properties of steam, generation of steam, wet steam, dryness fraction, enthalpy, specific volume, work done during vaporization, internal energy, super heated steam, entropy of water, saturated steam and superheated steams, steam tables, experimental methods of determination of the dryness fraction of steam, numerical.
4. Lubricants: Physical and chemical test of lubricant, method of applying lubrication, hand oiling, drop feed cup, ring type of lubrication, needle lubrication etc. Forced feed lubrication and greased lubrication.

UNIT – II

5. Element, Link, Kinematic Pair: Higher and lower pairs, sliding, turning, rolling pairs, screw pairs, spherical pairs, closed and unclosed pairs.
6. Belt drives: Types of belts, materials used for belts, types of flat belt drives, velocity ratio of belt drive, velocity ratio of a compound belt drive, slip of belt, creep of belt, length of open and cross belt drive, ratio of driving tensions for flat belt and v-belt, power transmitted, centrifugal effects on the belts, initial tension, maximum tension, condition for maximum power transmission. V-belt drive, advantages and disadvantages of V-belt drive over flat belt drive. Rope drive.
7. Chain drives: Bush roller chain and inverted tooth chain, to find the relation between pitch, pitch radius and number of teeth of the sprocket, calculation of chain length, angular speed ratio, advantages and disadvantages of chain drive over belt or rope drive.
8. Cams: Classification of cams according to cam shape, follower motion & type of constraint given to follower. Classification of followers according to surface in contact, motion of the follower and path of motion. Technical terms (base circle, trace point, pitch curve, pressure angle, pitch point, prime circle).

B. TECH. (TEXTILE CHEMISTRY) SEMESTER-II
(Under Credit Based Continuous Evaluation Grading System)

UNIT – III

9. Toothed gearing: Classification of toothed wheels according to the position of axes of the shaft, peripheral velocity of the gears and types of gearing, technical terms, helical and spiral gears.
10. Gear trains: Types of gear trains (simple, compound, reverted and epicyclic gear trains), their velocity ratio calculations.
11. Friction: Friction clutches, principal of disc or plate clutches, cone clutches and centrifugal clutches.
12. Airconditioning and humidification in Textile mills: Air conditioning and humidification, relative humidity, methods of humidification in textile mills. Drossopher, central disc humidifier, pneumatic humidifier, A.C. Plants in textile mills. Unit type and central station type plants, split system and all - air system of air conditioning. Space heating: calculation of heat loss by the deptt due to transmission and infiltration, net heat gain of the deptt. Critical temperature, calculation of minimum amount of infiltration permissible, advantages and disadvantages of various systems of humidification and air conditioning.

Texts:

1. Thermal Engineering by P.L. Ballaney. (1989 Edition), Published by Khanna Publishers, New Delhi.(For Part–A)
2. Theory of Machines - R. S. Khurmi & J. K. Gupta (1993 Edition), Chapters (6-8, 11-13, 19, 20). Published by Eurasia Publishing House Pvt. Ltd. New Delhi, (For Part–B)
3. Theory of Machines- S.S. Rattan. (1993 Edition), Chapters (2, 3, 7-11, 15). Published by Tata McGraw Hill Publishing Company Ltd. (For Part–B)
4. Humidification in Textile Mills-Textile Tablet II. (For Part–C)

TCL-103

COLOR SCIENCE**Credits: 3-1-0****UNIT – I****1. Introduction to the Physical Basis and Measurement of Color:**

Introduction, Measurement of light intensity, Planckian radiators and color temperature, Daylight and the CIE standard illuminants: standard illuminants and standard sources, sources of artificial light, the tungsten filament lamp, tungsten-halogen lamp, xenon lamps and gas discharge tubes, fluorescent lamps and tubes, properties of artificial light sources, color-matching booths and visual color matching, Interaction of light with matter, refraction, surface reflection, light scattering and diffuse reflection, color terms and definitions: hue, strength, depth, dullness and brightness. Light absorption, reflection and color: hue and wavelength position of light absorption, measurement of dye and pigment strength (quantitative analysis of dyes in solution: one component system, two component system and three component system), dullness and brightness characteristics. light interaction with atoms and molecules. (8)

2. Measurement of Color:

Introduction, the tristimulus colorimeter, spectrophotometer, reflectance measurements, spectrophotometer light sources, instrument geometries: 45/normal (45/0), normal/45 (0/45), diffuse/normal (D/0), normal/diffuse (0/D), dual beam spectrophotometer, application of transmission spectrophotometry to dyes: precautions in the analysis of dye solutions. (2)

UNIT – II**3. Colorimetry and the CIE System:**

Introduction, basic principles, additive and subtractive mixing, properties of additive mixing of light, possible color specification system: use of arbitrarily chosen primaries, inadequacy of real primaries, inadequacy of visual observation. Standard observer: color matching functions. Calculation of tristimulus values from measured reflectance values. The 1931 CIE system: standard primaries, standard light sources and standard illuminants (A, B and C), standard observer, standard illumination and viewing conditions, units. Additions to the CIE system: D illuminants, 1964 supplementary standard observer (10°), standard illuminating and viewing conditions, standard of reflectance factor, calculation of tristimulus values from R values measured at 20 nm intervals, relationship between tristimulus values and color appearance, chromaticity diagrams, usefulness and limitation of the CIE system, non-uniformity of the CIE system: color differences. Metamerism, color constancy and chromatic adaptation, color rendering of light sources. (10)

B. TECH. (TEXTILE CHEMISTRY) SEMESTER-II
(Under Credit Based Continuous Evaluation Grading System)

4. Color Order Systems, Color Spaces, Color Difference and Color Scales:

Color order systems and color spaces: Munsell color-order system: concept and realization. CIE xyY color space etc, color difference evaluation: reliability and fundamentals and various formulae such as CIE 1994 (L^* , C^*_{ab} , H^*_{ab}) color-difference formula, colorists' components of color and color difference. Evaluation of depth and relative depth: colorant strength and standardization, standard depths for fastness testing of colorants, relative cost of colorants, visual assessment of relative strength: single wavelength methods, (K/S) summation methods, methods based on color-order systems and color spaces. Evaluation of fastness-test results. Evaluation of whiteness and yellowness. (15)

UNIT – III

5. Recipe Prediction for Textiles:

Introduction, Computer colorant formulation, discussion on relationship of tristimulus values with spectral reflectance, and relationship of spectral reflectance with colorant concentration etc. (10)

Texts:

1. Color Physics for Industry by Roderick McDonald, Second Edition, 1997, Society of Dyers and Colorists, UK
2. The Chemistry of Colour Application by R.M. Christie, R.R. Mather and R.H. Wardman, 2000, Blackwell Science, London.

Reference Book:

1. Billmeyer and Saltzman's Principles of Color Technology by Roy S. Berns, 3rd Edition, 2000, John Wiley and Sons, Inc., New York.

B. TECH. (TEXTILE CHEMISTRY) SEMESTER-II
(Under Credit Based Continuous Evaluation Grading System)

PBL-131

ਪੰਜਾਬੀ ਲਾਜ਼ਮੀ-II

ਪ੍ਰੋ-ਕਲਿੰਗ ਏਕਸਪ੍ਰੈਸ ਪੇਸ਼ਕ-

Credits: 2-0-0

- (I) 1. ਏਕਸਪ੍ਰੈਸ ਏਕਸਪ੍ਰੈਸ (ਸਪ. ਵਿਏਮ ਏਕਸਪ੍ਰੈਸ ਸਿਏਕਸਪ੍ਰੈਸ. ਸਿਏਕਸਪ੍ਰੈਸ ਏਕਸਪ੍ਰੈਸ, ਗ੍ਰਿਨਿੰਕ ਏਕਸਪ੍ਰੈਸ, ਏਕਸਪ੍ਰੈਸ) ਏਕਸਪ੍ਰੈਸ- ਏਕਸਪ੍ਰੈਸ ਏਕਸਪ੍ਰੈਸ :
- (a) ਏਕਸਪ੍ਰੈਸ ਏਕਸਪ੍ਰੈਸ
(E) ਏਕਸਪ੍ਰੈਸ ਏਕਸਪ੍ਰੈਸ
(e) ਏਕਸਪ੍ਰੈਸ ਏਕਸਪ੍ਰੈਸ
(ਕਿਏਕਸਪ੍ਰੈਸ-ਸਿਏਕਸਪ੍ਰੈਸ, ਏਕਸਪ੍ਰੈਸ-ਏਕਸਪ੍ਰੈਸ ਕਿਏਕਸਪ੍ਰੈਸ, ਕਲਿੰਗ)
2. ਏਕਸਪ੍ਰੈਸ ਏਕਸਪ੍ਰੈਸ ਏਕਸਪ੍ਰੈਸ : ਏਕਸਪ੍ਰੈਸ, ਏਕਸਪ੍ਰੈਸ (ਏਕਸਪ੍ਰੈਸ, ਏਕਸਪ੍ਰੈਸ, ਏਕਸਪ੍ਰੈਸ ਏਕਸਪ੍ਰੈਸ-ਏਕਸਪ੍ਰੈਸ), ਸਿਏਕਸਪ੍ਰੈਸ |
- (II) 1. ਏਕਸਪ੍ਰੈਸ ਏਕਸਪ੍ਰੈਸ (ਸਪ. ਵਿਏਮ ਏਕਸਪ੍ਰੈਸ ਸਿਏਕਸਪ੍ਰੈਸ. ਸਿਏਕਸਪ੍ਰੈਸ ਏਕਸਪ੍ਰੈਸ, ਗ੍ਰਿਨਿੰਕ ਏਕਸਪ੍ਰੈਸ, ਏਕਸਪ੍ਰੈਸ) ਏਕਸਪ੍ਰੈਸ- ਏਕਸਪ੍ਰੈਸ ਏਕਸਪ੍ਰੈਸ :
- (a) ਏਕਸਪ੍ਰੈਸ ਏਕਸਪ੍ਰੈਸ
(E) ਏਕਸਪ੍ਰੈਸ ਏਕਸਪ੍ਰੈਸ
(e) ਏਕਸਪ੍ਰੈਸ ਏਕਸਪ੍ਰੈਸ
(ਕਿਏਕਸਪ੍ਰੈਸ-ਸਿਏਕਸਪ੍ਰੈਸ, ਏਕਸਪ੍ਰੈਸ-ਏਕਸਪ੍ਰੈਸ ਕਿਏਕਸਪ੍ਰੈਸ, ਕਲਿੰਗ)
2. ਏਕਸਪ੍ਰੈਸ ਏਕਸਪ੍ਰੈਸ : ਕਲਿੰਗ ਏਕਸਪ੍ਰੈਸ 10 ਏਕਸਪ੍ਰੈਸ- (ਏਕਸਪ੍ਰੈਸ ਏਕਸਪ੍ਰੈਸ, ਏਕਸਪ੍ਰੈਸ ਏਕਸਪ੍ਰੈਸ) ਏਕਸਪ੍ਰੈਸ ਏਕਸਪ੍ਰੈਸ ਏਕਸਪ੍ਰੈਸ ਏਕਸਪ੍ਰੈਸ
- (III) 1. ਏਕਸਪ੍ਰੈਸ ਏਕਸਪ੍ਰੈਸ (ਸਪ. ਵਿਏਮ ਏਕਸਪ੍ਰੈਸ ਸਿਏਕਸਪ੍ਰੈਸ. ਸਿਏਕਸਪ੍ਰੈਸ ਏਕਸਪ੍ਰੈਸ, ਗ੍ਰਿਨਿੰਕ ਏਕਸਪ੍ਰੈਸ, ਏਕਸਪ੍ਰੈਸ) ਏਕਸਪ੍ਰੈਸ- ਏਕਸਪ੍ਰੈਸ ਏਕਸਪ੍ਰੈਸ :
- (a) ਏਕਸਪ੍ਰੈਸ ਏਕਸਪ੍ਰੈਸ ਏਕਸਪ੍ਰੈਸ
(E) ਏਕਸਪ੍ਰੈਸ ਏਕਸਪ੍ਰੈਸ
(e) ਏਕਸਪ੍ਰੈਸ ਏਕਸਪ੍ਰੈਸ
(s) ਏਕਸਪ੍ਰੈਸ
(ਕਿਏਕਸਪ੍ਰੈਸ-ਸਿਏਕਸਪ੍ਰੈਸ, ਏਕਸਪ੍ਰੈਸ-ਏਕਸਪ੍ਰੈਸ ਕਿਏਕਸਪ੍ਰੈਸ, ਕਲਿੰਗ)
2. ਏਕਸਪ੍ਰੈਸ ਏਕਸਪ੍ਰੈਸ ਏਕਸਪ੍ਰੈਸ (ਏਕਸਪ੍ਰੈਸ ਏਕਸਪ੍ਰੈਸ ਏਕਸਪ੍ਰੈਸ 200 ਏਕਸਪ੍ਰੈਸ- ਏਕਸਪ੍ਰੈਸ 100 ਏਕਸਪ੍ਰੈਸ- ਏਕਸਪ੍ਰੈਸ ਏਕਸਪ੍ਰੈਸ ਏਕਸਪ੍ਰੈਸ ਏਕਸਪ੍ਰੈਸ ਏਕਸਪ੍ਰੈਸ ਏਕਸਪ੍ਰੈਸ |

PBL-132: ਮੁੱਢਲੀ ਪੰਜਾਬੀ
(In lieu of Punjabi Compulsory)

2-0-0

ਪਾਠ-ਕ੍ਰਮ

1. ਪੰਜਾਬੀ ਸ਼ਬਦ-ਬਣਤਰ
ਸੰਯੁਕਤ ਅਤੇ ਮਿਸ਼ਰਤ ਸ਼ਬਦ
ਬਹੁ-ਉਚਾਰਖੰਡੀ ਸ਼ਬਦ
2. ਪੰਜਾਬੀ ਵਾਕ-ਬਣਤਰ
ਸਾਧਾਰਨ-ਵਾਕ : ਕਿਸਮਾਂ
ਸੰਯੁਕਤ-ਵਾਕ : ਕਿਸਮਾਂ
ਮਿਸ਼ਰਤ-ਵਾਕ : ਕਿਸਮਾਂ
3. ਪ੍ਰਕਾਰਜੀ ਪੰਜਾਬੀ
ਚਿੱਠੀ ਪੱਤਰ
ਪੈਰਾ ਰਚਨਾ
ਸੰਖੇਪ ਰਚਨਾ
ਅਖਾਣ ਅਤੇ ਮੁਹਾਵਰੇ

ਯੂਨਿਟ ਅਤੇ ਥੀਮ

1. ਪੰਜਾਬੀ ਸ਼ਬਦ-ਬਣਤਰ : ਸੰਯੁਕਤ ਸ਼ਬਦ; ਸਮਾਸੀ ਸ਼ਬਦ (ਜਿਵੇਂ ਲੋਕ ਸਭਾ); ਦੋਜਾਤੀ ਸ਼ਬਦ (ਜਿਵੇਂ ਕਾਲਾ ਸਿਆਹ); ਦੋਹਰੇ ਸ਼ਬਦ/ਦੁਹਰਰੁਕਤੀ (ਜਿਵੇਂ ਧੂੜ ਧਾੜ/ਭਰ ਭਰ), ਮਿਸ਼ਰਤ ਸ਼ਬਦਾਂ ਦੀ ਬਣਤਰ/ਸਿਰਜਨਾ; ਅਗੇਤਰਾਂ ਰਾਹੀਂ (ਜਿਵੇਂ ਉਪ ਭਾਸ਼ਾ), ਪਿਛੇਤਰਾਂ ਰਾਹੀਂ (ਜਿਵੇਂ ਰੰਗਲਾ), ਪੰਜਾਬੀ ਸ਼ਬਦ ਰਚਨਾ-2: ਪੜਨਾਵੀਂ ਰੂਪ, ਕਿਰਿਆ/ਸਹਾਇਕ ਕਿਰਿਆ ਦੇ ਰੂਪ; ਨਿੱਤ ਵਰਤੋਂ ਦੀ ਪੰਜਾਬੀ ਸ਼ਬਦਾਵਲੀ-2: ਮਾਰਕੀਟ/ਬਾਜ਼ਾਰ, ਵਪਾਰ, ਧੰਦਿਆਂ ਨਾਲ ਸੰਬੰਧਿਤ।
2. ਪੰਜਾਬੀ ਵਾਕ-ਬਣਤਰ : ਕਰਤਾ ਕਰਮ ਕਿਰਿਆ; ਸਾਧਾਰਨ ਵਾਕ, ਬਿਆਨੀਆ, ਪ੍ਰਸ਼ਨਵਾਚਕ, ਆਗਿਆਵਾਚਕ, ਸੰਯੁਕਤ ਅਤੇ ਮਿਸ਼ਰਤ ਵਾਕਾਂ ਦੀਆਂ ਕਿਸਮਾਂ; ਸੁਤੰਤਰ ਅਤੇ ਅਧੀਨ ਉਪਵਾਕ; ਸਮਾਨ (ਤੇ/ਅਤੇ) ਅਤੇ ਅਧੀਨ (ਜੋ/ਕਿ) ਯੋਜਕਾਂ ਦੀ ਵਰਤੋਂ; ਪੰਜਾਬੀ ਵਾਕਾਂ ਦੀ ਵਰਤੋਂ : ਵਿਭਿੰਨ ਸਮਾਜਕ/ਸਭਿਆਚਾਰਕ ਪ੍ਰਸਥਿਤੀਆਂ ਦੇ ਅੰਤਰਗਤ; ਘਰ ਵਿਚ, ਬਾਜ਼ਾਰ ਵਿਚ, ਮੇਲੇ ਵਿਚ, ਸ਼ੋਪਿੰਗ ਮਾਲ/ਸਿਨੇਮੇ ਵਿਚ, ਵਿਆਹ ਵਿਚ, ਧਾਰਮਿਕ ਸਥਾਨਾਂ ਵਿਚ, ਦੋਸਤਾਂ ਨਾਲ ਆਦਿ।
3. ਇਸ ਯੂਨਿਟ ਵਿਚ ਚਿੱਠੀ ਪੱਤਰ (ਨਿੱਜੀ/ਦਫ਼ਤਰੀ/ਵਪਾਰਕ), ਪੈਰਾ ਰਚਨਾਂ, ਸੰਖੇਪ ਰਚਨਾ ਅਤੇ ਅਖਾਣ ਮੁਹਾਵਰਿਆਂ ਦੀ ਵਰਤੋਂ ਰਾਹੀਂ ਵਿਦਿਆਰਥੀ ਦੀ ਭਾਸ਼ਾਈ ਯੋਗਤਾ ਨੂੰ ਪਰਖਿਆ ਜਾਵੇਗਾ।

B. TECH. (TEXTILE CHEMISTRY) SEMESTER-II
(Under Credit Based Continuous Evaluation Grading System)

Subject Code: ENL-151

Duration of Examination : 3 Hrs

Course Title: **Communicative English-II**

Credits : 02 (L=2,T=0,U=0)

Objectives: To Introduce students in a graded manner to the communication skills of Reading and Writing in English. At the end of semester II, the students should be able to demonstrate adequate competence in comprehending an unseen passage and performing the prescribed communication/writing tasks.

Prescribed Book: Vandana R. Singh, The Written Word, Oxford University Press, New Delhi (Selected Chapters).

Reading:

a) Developing Comprehension Skills:

Students will be required to read sample comprehension passage as given in Chapter *Critical Reading and Comprehension* of the prescribed book. The teacher will help students in handling text and answering questions given at the end of each passage.

Teacher can bring in more texts and construct questions of factual and inferential nature to enhance the comprehension skills of the students.

b) Developing Habits of Additional Reading:

The students will be required to show evidence of additional independent reading. They will maintain a scrapbook consisting of such readings as clippings from newspapers and magazines, short articles, stories etc. The minimum quantum of such additional reading will be decided by the class teacher, who will also test students individually on their additional reading (and appropriately award internal assessment, if required).

B. TECH. (TEXTILE CHEMISTRY) SEMESTER-II
(Under Credit Based Continuous Evaluation Grading System)

Writing:

a) Developing Vocabulary and using it in the Right Context:

Students will be required to pay special attention to build up their vocabulary. They should master the contents of the chapter on *Vocabulary* in the prescribed book. Teacher will help the students learn the correct and appropriate use of the given set of words/phrases/expressions.

b) Developing Skills in Formal Writing:

Students will be required to do write-ups involving skills of making formal complaints, requests, orders etc., reporting, note taking, summarizing and transcoding. The types of composition task may include business and public interest letters, news/features writing, speeches, minutes, instructions, summary reports etc. Teacher shall instruct the students about the appropriate format and usual conventions followed in such writings. The following chapters in the prescribed book may be consulted for exercise materials on these tasks:

1. Paragraph and essay writing
2. Report Writing
3. Letter Writing
4. Note Making and Summarizing
5. Transcoding

Recommended Books:

1. A Course in Grammar and Composition by Geeta Nagaraj, Foundation Book, 2006.
2. Oxford Guide to Effective Writing and Speaking by John Seely.

B. TECH. (TEXTILE CHEMISTRY) SEMESTER-II
(Under Credit Based Continuous Evaluation Grading System)

MTL -122

APPLIED MATHS

Credits: 3-1-0

UNIT-I

Differential Calculus: Partial derivatives, Euler's theorem for homogeneous functions, total derivative, change of variables, Maxima and minima of functions of two variables, Lagrange's methods of undetermined multipliers.

Complex Numbers: De Moivre's theorem and its applications, Exponential, Logarithmic, Circular and Hyperbolic functions of complex variables inverse functions and their real and imaginary parts. Summation of series.

UNIT-II

Differential Equations: Formation of differential equations, solutions of first order and first degree differential equations, Exact differential equations, integrating factors, Linear differential equations, Cauchy's form, Legendre linear equations, simultaneous linear equations with constant coefficients, Total differential equations.

Matrices: Linear dependence, Rank of a matrix, applications to solution of system of linear equations, linear transformations, Orthogonal, Unitary and Hermitian matrices, Eigen values and Eigen Vectors, Reduction of diagonal form. Cayley-Hamilton theory, Bilinear and Quadratic forms.

UNIT-III

Double & Triple Integration: Evaluation of double and triple integrals, interchange of order of integration, Areas by double integration. Evaluation of volumes of solids.

Fourier Series: Euler's formula, Fourier expansion, Change of interval, Expansions of odd and even periodic functions, Half range series, Harmonic analysis.

Text:

1. N.P. Bali: A Text Book of Engineering Mathematics.
2. B.S.Grewal: Higher Engineering Mathematics
3. Kreyszig Erwin: Advanced Engineering Mathematics

B. TECH. (TEXTILE CHEMISTRY) SEMESTER-II
(Under Credit Based Continuous Evaluation Grading System)

TCL-002: Textile Care* / Interdisciplinary Course- II

Credits: 3-1-0

* **Textile Care:** Interdisciplinary course for other departments.

Note: Interdisciplinary Course II: Students of B.Tech Textile Chemistry has to select a interdisciplinary course floated by other departments.

B. TECH. (TEXTILE CHEMISTRY) SEMESTER-II
(Under Credit Based Continuous Evaluation Grading System)

TCP-102**TEXTILE TESTING LAB (CHEMICAL)****Credits: 0-0-3****SECTION A: VOLUMETRIC ANALYSIS**

1. Quantitative estimation of given alkali sample
2. Quantitative estimation of given acid sample
3. To determine the strength of given oxidizing agent
4. To determine the strength of given reducing agent
5. To determine the temporary and permanent hardness of given water sample

SECTION B: GRAVIMETRIC ANALYSIS

6. To determine the fibre content of given pure fibre/yarn/fabric sample
7. To determine the blend composition of a given sample having two fibres
8. To determine the blend composition of given shoddy sample quantitatively
9. To determine the oil/grease content in the given wool sample by Soxhlet method

SECTION C: MISCELLANEOUS

10. To distinguish between Nylon 6 and Nylon 66
11. To identify the class of dye on the given cellulosic fabric
12. To identify the class of dye on the given woollen fabric/yarn
13. To identify the class of dye on the given synthetic fabric/yarn
14. To determine the cloud point of given non-ionic detergent
15. To determine the biochemical oxygen demand (BOD) of given wastewater sample
16. To determine the chemical oxygen demand (COD) of given wastewater sample
17. To determine the solid content and active content of an anionic/cationic surfactant in terms of molarity
18. To determine the solid content and active content of binder
19. To determine the solid content and silicon oil content in silicon emulsion.

Text:

1. Evaluation of Textile Chemicals Vol. VIII by V.A. Shenai and R.H. Mehra.
2. Vogel's textbook of quantitative inorganic analysis by J. Bassett.
3. Process House laboratory- A Handbook by Girish Luthra, Bapu Dehspande, MANTRA.
4. Handbook of Textile Testing (Part I, IV), Bureau of Indian Standards.
5. Detergent Analysis (Handbook for cost effective quality control) by B.M. Mildwidsky & D.M. Gabriel.
6. Standard Methods for the examination of water and wastewater by APHA (American Public Health Association, USA).

B. TECH. (TEXTILE CHEMISTRY) SEMESTER-II
(Under Credit Based Continuous Evaluation Grading System)

STP-104

DESIGN AND DRAWING LAB

Credits: 0-0-2

Drawing: Sketch on the following:

1. Types of Rivets.
2. a) Single riveted Lap Joint
b) Double riveted Lap joint
(Zignagriveting and Chain riveting)
3. Types of the welded joints.
4. Thread terms and nomenclature.
5. Types of V/thread forms for fastening.
6. Types of square thread family.
7. Drawing of Hexagonal nut.
8. Hexagonal heated bolt and hexagonal nut assembly.
9. Square headed bolt and square nut assembly.
10. Machine Screws.
11. Types of keys.
12. Pin type flexible coupling.
13. Dimensioning: Dimensioning terms and notations important dimensioning rules, dimensioning common features.
14. Orthographic projections Projection terms first angle and third angle orthographic projection method of obtaining orthographic projections in third angle. View analysis. Comparison of first & third angle projections.

Text:

Machine Drawing by P.S. Gill, Latest Edition, B.D. Kataria & Sons, Opp. Clock Tower.

TCL-201

CELLULOSIC DYEING TECHNOLOGY

Credits: 3-1-0

UNIT – I

Section A: Machines for Dyeing Fabric Continuously:

Pad mangles: Padding boxes, various types, Nip rollers, arrangement of rollers, dimensions of nip rollers, construction of nip rollers, special designs of mangle bowls, care of rubber rollers, application of pressure to the rollers, The drive, liquor pick-up, safety and uniformity of expression. Vacuum impregnation, Drying prior to fixation

UNIT – II

Section B: Chemistry of Cellulosic Dyes:

Reactive systems based on cyanuric chloride viz. dichloro-s-triazines, monochloro-s-triazine, bis(monochloro-s-triazine) and other heterocyclic systems. Alternative leaving groups on heterocyclic systems such as: quaternary ammonium groups, fluoro and methylsulphonyl groups. Chromogens used in halogenoheterocyclic reactive dyes viz. yellow, reddish-yellow, orange, scarlet, red, rubine and violet, dull blues, navy blue, brown, tarquoise, green and black. Vinyl sulphone and vinyl sulphonamide dyes, reaction mechanism and properties of vinyl sulphone dyes. Intermediates for vinyl sulphone dyes, chromogens used in vinyl sulphone dyes, vinyl sulphonamide dyes. Application of reactive dyes to polyester cotton blends. Reactive dyes for wool and nylon. Polycyclic vat dyes based on: anthraquinone systems, indanthrones, benzantrones, carbazoles, acridones: brief knowledge about their structures and general characteristics (synthetic methods excluded). Indigoid and thioindigoid dyes: brief knowledge about their structures and general characteristics (synthetic methods excluded). Sulphur and thiazole dyes: structural features.

UNIT – III

Section C: Technology of Cellulosics Dyeing

1. **Dyeing with Direct Dyes:**

Introduction, structure and properties of direct dyes for cellulose, dye structure and dyeability of cellulose fibres, application properties of direct dyes, batchwise application of direct dyes, semi and fully continuous dyeing processes for direct dyes, aftertreatment processes for direct dyeings.

2. **Dyeing with Reactive Dyes:**

Batchwise application, semi and fully continuous application, washing off and aftertreatments, stability of dye-fibre bond.

3. **Dyeing with Vat Dyes:**

Introduction, fundamental principles, fundamental processes of vat dyes, dyeing methods.

4. **Dyeing with Sulphur Dyes:**

Commercial position, classification and commercial forms, auxiliaries, application methods, fastness performance, common faults.

B. TECH. (TEXTILE CHEMISTRY) SEMESTER-III
(Under Credit Based Continuous Evaluation Grading System)

5. **Dyeing with Azoic Components:**

Introduction, chemical constitution and hue obtainable, treatment with naphthols, intermediate treatments, development, aftertreatment, dyeing of mercerized cotton and other cellulose, fastness of azoic dyeings, stripping of azoic dyeings.

Recommended Books:

Section – A:

1. Engineering in Textile coloration edited by C. Duckworth (1983 edition), Chapter 1 pages 1-68. The Dyers company publication trust, distributed by The Society of Dyers and Colorists (SDC), UK.

Section – B:

2. Colorants and Auxiliaries, Volume –I, edited by John Shore, The Society of Dyers and Colorists (SDC), UK (Chapters 6 and 7).
3. Reactive dyes for Textile fibres by A. Hunter M. Renfrew, 1999, The Society of Dyers and Colorists (SDC), UK.

Section – C:

4. Cellulosics dyeing edited by John Shore (1995 edition). Chapters 3-7. The Dyers Company Publication Trust, distributed by The Society of Dyers and Colorists (SDC), UK.

TCL-202

PRETREATMENT TECHNOLOGY-I

Credits: 3-1-0

UNIT – I

1. **Shearing, Cropping and Singeing:**
Different sequences of processes in a cotton textile mill. Singeing machines-Roller singeing m/c, Plate singeing m/c, Gas singeing m/c., Device for obtaining combustible mixture, singeing of fabrics made from synthetic fibres or blends. (5)
2. **Desizing:**
Sizing, characteristics of warp size. Desizing, classification of desizing methods, hydrolytic methods & oxidative methods, high temperature enzymatic desizing, desizing of textiles having PVA based sizes. (7)

UNIT – II

3. **Scouring:**
Introduction, Scouring of cotton, details of the scouring process, Efficiency of kier boiling, Estimation of degradation of cotton undergone during scouring. Modern kiers, methods of heating, circulation of liquor, batch and continuous scouring, Vaporloc unit. J-boxes, scouring of coloured woven goods. Enzymatic scouring, basic principles involved in enzymatic scouring, comparison with conventional scouring, Solvent scouring, dry-cleaning. (13)

UNIT – III

4. **Bleaching:**
Application of Reducing & Oxidizing bleaching agents, Bleaching cellulosic fabrics with hypochlorites, Bleaching with peroxides, Bleaching with Sodium Chlorite, Bleaching with peracetic acid, low temperature bleaching for minimum fibre damage, Reaction Mechanism of the principle bleaching processes, Application of FBAs to fibres, Yarns & Fabrics, Assessment of bleaching performance, Whiteness index, Yellowness index. (15)
5. **Combined Pretreatment Processes:**
Combined desizing and bleaching, combined scouring and bleaching, combined desizing, scouring and bleaching. (5)

Texts:

- 1) Chemical Technology in the Pre-treatment Processes of Textiles by S.R. Karmakar, Published by Elsevier Publications, The Netherlands.
- 2) Textile Scouring & Bleaching by E.R. Trotman, Published by B.I. Publications Pvt.Ltd, New Delhi.
- 3) Technology of Bleaching & Mercerization Vol. III by Dr. V. A. Shenai, Published by Sevak Publications.
- 4) Handbook of Fibre Science and Technology- Volume–I Chemical Properties of Fibers and Fabrics Fundamentals and Preparation Part–A. Edited by Mena Chem Lewin and Stephen B–Sello. Published by Marcel Dekker Inc. New York.

TCL-203

FIBRE SCIENCE**Credits: 3-1-0****UNIT – I****1. Classification of Textile Fibres:**

Classification of textile fibres according to their origin and constitution. (1)

2. Fibre Morphology and Properties of Textile Fibres:

Essential characteristics of fibre forming polymers, molecular arrangement, Chemical constitution of different fibres, types of inter and intra-molecular forces of attraction in fibre forming polymer systems (hydrogen bonds, covalent bonds, Vander-Waals forces of attraction), approaches to describe fibre fine structure: one and two phase models for natural cellulosic fibres, regenerated and modified celluloses, protein fibres, synthetic fibres.

(5)

3. Individual Fibre Details of Natural Fibres:**A. Natural Fibres:**

a) **Cellulosic Fibres:** hydrocellulose and oxycellulose, Cotton: Chemical nature, nature of impurities, cotton grading, physical and chemical properties, Flax, linen, jute, ramie, hemp.

b) Protein Fibres:

i) **Wool Fibre Properties:** composition and nature of impurities, classification of wool, physical and chemical properties.

ii) **Brief Discussion of other Hair Fibres:** Mohair, Cashmere, Angora, Camel hair, etc.

iii) **Silk Fibre Properties:** fibroin and sericin, sericulture, processing of silk, difference between wool and silk.

(10)

UNIT – II**B. Man-Made Fibres:**

a) **Introduction:** Definition, evolution of manufactured fibres, Fibre forming processes, fibre products and properties, production trends, application areas. (1)

b) **Raw Materials:** Dimethyl terephthalate (DMT). Terephthalic acid (TPA)-Henkel-I process. Henkel-II process. Mobil process. Amoco process. Teijin process. Monoethylene glycol. Caproactam-Synthesis from phenol, toluene, cyclohexane and aniline. Adipic acid- Synthesis from phenol, Cyclohexane, Tetrahydrofuran (THF), butadiene, Hexamethylene diamine. Acrylonitrile- From acetylene, Ethylene oxide, Propylene.

(2)

B. TECH. (TEXTILE CHEMISTRY) SEMESTER-III
(Under Credit Based Continuous Evaluation Grading System)

c) Polymerisation: General information about polymers-Types of polymers, polymerization reactions. Production of poly (ethylene terephthalate) polymer-Advantages of TPA over DMT. The chemical reactions for PET preparation. Side reactions, Polycondensation reaction. Batch process. Continuous process. Production of nylon 66 polymer-Preparation of HA salt. Polycondensation. Continuous polymerization process. Production of nylon 6 polymer-Parameters in water catalyzed system. Mechanism of polymerization. Conditions for an optimal polymerization. Batch process. Continuous process. Integrated continuous process. Production of polymer for making acrylic fibre-Methods of polymerization. Mechanism of polymerization. Batch process. Semi batch process. Continuous process. Production of polypropylene polymer-Polymerization processes. Suspension and Gas phase polymerization.

(8)

d) Melt Spinning: The melt spinning line, Extruders, melt spinning variables and conditions for continuous spinning, special features of high speed spinning, the role of some critical parameters and their variation along the spinline, structure formation during spinning, integrated spin draw process

(3)

e) Wet and Dry Spinning: Introduction. Preparation of dope. Wet spinning-Post spinning operations. Fibre formation and coagulation variables. Development of structure and morphology, Dry spinning, comparative look at wet and dry spinning process. Dry jet-wet spinning. Manufacturing processes of viscose, cuprammonium rayon, cellulose acetate, cellulose triacetate, high tenacity cellulosic fibres, polynosic rayons, chemically modified cellulosic fibres.

(5)

f) Spin Finishes: Functions of spin finish- Desirable properties of a spin finish. Chemical constitution of a spin finish- Lubricants, Antistatic agents, Emulsifiers. Methods of application of spin finish. Spin finishes for polyester staple fibre. Spin finishes for texturing process, Spin finish and snow formation. Effect of spin finish on dyeing. Problems encountered during the use of spin finish.

(2)

g) Drawing: The drawing unit, the drawing behaviour of thermoplastic polymers, influence of drawing on structure and properties of synthetic fibres, orientation for high strength, high speed spinning and the spin draw process, drawing of preoriented yarns and draw warping.

(2)

B. TECH. (TEXTILE CHEMISTRY) SEMESTER-III
(Under Credit Based Continuous Evaluation Grading System)

h) Texturing: False twist process- Heat setting and yarn texturing. Factors influencing properties of textured yarns. Feed material characteristics. Texturing process variables. Texturing machine design. Draw texturing- Draw texturing machines. Comparison between pin spindle and friction discs. The main quality problems in friction twisting. New developments in friction texturing. Beltex units. Ringtex units. Air Jet texturing, gear crimping, Stuffer box Texturing, Knife edge crimping. Knit de-knit process.

(4)

i) Staple Fibre Production: Melt spinning- advantages and drawbacks of direct spinning. Manifold and spin pack. Quenching, finish application and collection of filaments in cans. spinning plants with bigger capacities. Drawing, Heat setting, Crimping etc. in Fibre Line- Drawing of tow. Preliminary heat setting, Crimping, Drying and final heat setting. Cutting. Baling. High production fibre lines. One step continuous plant for the production of melt spun staple fibres. Production of polypropylene staple fibre-Compact or short spinning Plants. Polyester tops for wool blending.

(3)

UNIT – III

j) Heat-Setting: Introduction. Physics of heat-setting. Heat-setting and structural parameters. Mechanisms of heat-setting-Glass transition. Heat setting behaviour of polyamide and polyester fibres, heat setting of cellulose triacetate fibres, settability and the measurement of the degree of set.

(2)

k) Physical and Chemicals Properties: PET, Nylon, PP and Acrylic and their comparative studies.

(2)

4. Modified Synthetic Fibres: Drawbacks of synthetic fibres. Commercial importance of modified fibres. Preparation of modified synthetic fibres. Modified polyester fibres- Hydrophilic polyester. Hollow polyester. Low pilling polyester. Flame retardant polyester. Carrier-free dyeable polyester. Cationic dyeable polyester fibre. Silk like polyester. Modified nylon- Hydrophilic and antistatic nylon. Low pilling nylon. Flame retardant nylon, Differentially dyable nylons. Modified acrylic fibres- Hydrophilic acrylic fibres. Low pilling acrylic fibres. Flame retardant acrylic fibres. Bicomponent acrylic fibres. Differentially dyable acrylic fibres. Modified polypropylene.

(5)

B. TECH. (TEXTILE CHEMISTRY) SEMESTER-III
(Under Credit Based Continuous Evaluation Grading System)

5. High Performance Fibres: Aromatic polyamides (Kevlar and Nomex) and polyesters, Spectra, Teflon, glass, carbon fibres, metallic fibres.

(5)

Texts:

1. Manufactured Fibre Technology, V.B. Gupta and V.K. Kothari, Chapman and Hall, 1997. (Chapter 1, 4, 5, 6, 7, 11)
2. Production of Synthetic Fibres by A.A. Vaidya, Prentice Hall of India Pvt. Ltd., (Chapter 2, 3, 8, 9, 10).
3. Handbook of Textile Fibres: Natural Fibres (Vol.-1) and Man Made Fibres (Vol.-2) by J. Gordon Cook, Published by Merrow Publishing Co. Ltd. England.

ESL 220: Environmental Studies (Compulsory)

Credit: 3-0-0

- 1. The multidisciplinary nature of environmental studies:** Definition, scope & its importance, Need for public awareness.
- 2. Natural Resources:** Natural resources and associated problems.
 - a) Forest Resources:** Use of over exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people.
 - b) Water Resources:** Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.
 - c) Mineral Resources:** Use and exploitation, environmental effects of extracting and using mineral resources, case studies.
 - d) Food resources:** World food problems, change caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problem, salinity, case studies.
 - e) Energy Resources:** Growing of energy needs, renewable and non-renewable energy resources, use of alternate energy sources, case studies.
 - f) Land Resources:** Land as a resource, land degradation, soil erosion and desertification.
 - g) Role of an individual in conservation of natural resources, Equitable use of resources for sustainable lifestyles.**
- 3. Ecosystem:**

Concept of an ecosystem, Structure and function of an ecosystem, Producers, consumers and decomposers, Energy flow in the ecosystem, Ecological succession, Food chains, food webs and ecological pyramids.

Introduction, types, characteristic features, structure and function of the following ecosystems:

 - a. Forest ecosystem
 - b. Grassland ecosystem
 - c. Desert ecosystem
 - d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries).

B. TECH. (TEXTILE CHEMISTRY) SEMESTER-III
(Under Credit Based Continuous Evaluation Grading System)

4. Biodiversity and its Conservation:

Definition: Genetic, species and ecosystem diversity, Biogeographical classification of India.

Value of Biodiversity: Consumptive use; productive use, social, ethical, aesthetic and option values.

Biodiversity of global, National and local levels, India as mega-diversity nation "Hot-spots of biodiversity.

Threats to Biodiversity: Habitat loss, poaching of wild life, man wildlife conflicts
Endangered and endemic species of India.

Conservation of Biodiversity: In situ and Ex-situ conservation of biodiversity.

5. Environmental Pollution:

Definition, Causes, effects and control measures of:

- a) Air Pollution
- b) Water Pollution
- c) Soil Pollution
- d) Marine Pollution
- e) Noise Pollution
- f) Thermal Pollution
- g) Nuclear Hazards

Solid Waste Management: Causes, effects and control measures of urban and industrial wastes.

Role of an individual in prevention of pollution.

Pollution case studies Disaster Management: Floods, Earthquake, Cyclone and Landslides

6. Social Issues and Environment:

- * From unsustainable to sustainable development
- * Urban problems related to energy
- * Water conservation, rain water harvesting, watershed management
- * Resettlement and rehabilitation of people; its problems and concerns. Case studies
- * Environmental ethics: Issues and possible solutions.
- * Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies.
- * Wasteland reclamation
- * Consumerism and waste products
- * Environmental Protection Act
- * Air (prevention and Control of Pollution) Act
- * Water (prevention and Control of Pollution) Act
- * Wildlife Protection Act
- * Forest Conservation Act
- * Issues involved in enforcement of environmental legislation
- * Public awareness

B. TECH. (TEXTILE CHEMISTRY) SEMESTER-III
(Under Credit Based Continuous Evaluation Grading System)

7. Human population and the environment

- * Population growth, variation among nations
- * Population explosion-Family welfare programme
- * Environment and human health
- * Human rights
- * Value education
- * HIV / AIDS
- * Women and child welfare
- * Role of information technology in environment and human health
- * Case studies

* **Road Safety Rules & Regulations:** Use of Safety Devices while Driving, Do's and Don'ts while Driving, Role of Citizens or Public Participation, Responsibilities of Public under Motor Vehicle Act, 1988, General Traffic Signs

* **Accident & First Aid:** First Aid to Road Accident Victims, Calling Patrolling Police & Ambulance

8. Field Work: Visit to a local area to document environmental assets—river / forest / grassland / hill / mountain. Visit to a local polluted site—Urban / Rural / Industrial / Agricultural. Study of common plants, insects, birds. Study of simple ecosystems—pond, river, hill slopes, etc. (Field work equal to 5 lecture hours).

References:

1. Agarwal, K. C. 2001. Environmental Biology, Nidhi Publications Ltd. Bikaner.
2. Bharucha, E. 2005. Textbook of Environmental Studies, Universities Press, Hyderabad.
3. Bharucha, E. 2004. The Biodiversity of India, Mapin Publishing Pvt. Ltd. Ahmedabad.
4. Brunner, R. C. 1989. Hazardous Waste Incineration, McGraw Hill Inc. New York.
5. Clark, R. S. 2000. Marine Pollution, Clanderson Press Oxford.
6. Cunningham, W. P., Cooper, T. H., Gorhani, E. & Hepworth, M. T. 2001. Environmental Encyclopedia, Jaico Publications House, Mumbai.
7. De, A. K. 1989. Environmental Chemistry, Wiley Eastern Ltd.
8. Down to Earth, Centre for Science and Environment, New Delhi.
9. Hawkins, R. E. 2000. Encyclopedia of Indian Natural History, Bombay Natural History Society.
10. Heywood, V. H & Waston, R. T. 1995. Global Biodiversity Assessment, Cambridge House, Delhi.

B. TECH. (TEXTILE CHEMISTRY) SEMESTER-III
(Under Credit Based Continuous Evaluation Grading System)

11. Jadhav, H. & Bhosale, V. M. 1995. Environmental Protection and Laws. Himalaya Pub.
12. Joseph, K. and Nagendran, R. 2004. Essentials of Environmental Studies, Pearson Education (Singapore) Pte. Ltd., Delhi.
13. Kaushik, A. & Kaushik, C. P. 2004. Perspective in Environmental Studies, New Age International (P) Ltd, New Delhi.
14. Miller, T. G. Jr. 2000. Environmental Science, Wadsworth Publishing Co.
15. Odum, E. P. 1971. Fundamentals of Ecology. W.B. Saunders Co. USA.
16. Rajagopalan, R. 2005. Environmental Studies from Crisis to Cure. Oxford University Press, New Delhi.
17. Sharma, B. K. 2001. Environmental Chemistry. Geol Publishing House, Meerut.
18. Sharma, J. P. 2004. Comprehensive Environmental Studies, Laxmi Publications (P) Ltd, New Delhi.
19. Sharma, P. D. 2005. Ecology and Environment, Rastogi Publications, Meerut.
20. Subramanian, V. 2002. A Text Book in Environmental Sciences, Narosa Publishing House, New Delhi.
21. Survey of the Environment. 2005. The Hindu.
22. Tiwari, S. C. 2003. Concepts of Modern Ecology, Bishen Singh Mahendra Pal Singh, Dehra Dun.
23. Townsend, C., Harper, J. and Michael, B. 2001. Essentials of Ecology, Blackwell Science.
24. Booklet on Safe Driving. Sukhmani Society (Suvidha Centre), District Court Complex, Amritsar.

TCL-204

TEXTILE TESTING-I

Credits: 3-1-0

UNIT – I

1. **Introduction to Testing:** The objective of testing, tested quality schemes.
2. **The Selection of Samples for Testing:** Random and biased samples, sampling for determination of fiber properties, yarn sampling method- the use of random numbers, fabric sampling.
3. **Moisture Relations and Testing:** Introduction, regain and moisture content, atmospheric conditions and relative humidity, standard atmosphere, testing atmosphere, measurement of atmospheric conditions-dry and wet bulb hygrometers, hair hygrometers, electrolytic hygrometers, sling and Assmann type hygrometers. Regain-humidity relation of textiles-absorption curves of various materials, some factors affecting the regain of textile materials, interpretation of regain values, absorption and desorption curves. Effects of regain on fibre properties and dimensions. Measurement of regain- correct invoice weight, Shirley moisture meter.

UNIT – II

4. **Fibre Dimensions and Quality:** Cotton fibre length measurement- The Shirley comb sorter, analysis of sorter diagram- average or mean length, maximum length, modal length, effective length, relationship between effective length and staple length, percentage short fibre, dispersion, the 'Uster' staple diagram apparatus, the Shirley photoelectric stapler, the fibrograph, digital fibrograph, span length, uniformity ratio and floating fibre percentage.
5. **The Measurement of Fibre Fineness & Maturity:** Importance of fibre fineness, definition of fibre fineness, methods of measuring fibre fineness- Air flow methods-Sheffield micronaire for cotton and wool, Arealometer, measurement of fibre fineness by vibroscope.

UNIT – III

6. **Maturity of Cotton:** Maturity ratio, maturity count, standard fibre weight per cm, relation between immaturity count and fibre weight. Differential dyeing- the Goldwaite test for maturity, use of polarized light. Cotton fibre quality- American cotton grading. The measurement of Trash content- The Shirley Trash Analyzer, the SRRL non-lint tester.
7. **Yarn Dimensions:** Linear density, count or yarn number, direct and indirect systems of yarn numbering, tex, denier, English count, woolen & worsted count. Wrap reel, Knowles balance, doubled yarn count calculations, yarn count and yarn diameter.
8. **Twist and Twist Measurement:** Twist direction, twist angle, function of twist in the yarn structure, twist and yarn strength, some effects twist on fabric properties, measurement of twist, yarn hairiness, crimp rigidity.

Text:

Principles of Textile Testing by J.E. Booth, 3rd Edition, Published by CBS Publishers & Distributors, New Delhi.

B. TECH. (TEXTILE CHEMISTRY) SEMESTER-III
(Under Credit Based Continuous Evaluation Grading System)

TCP-201

CELLULOSIC DYEING LAB

Credits: 0-0-3

1. Application of different classes of dyes on natural fibres/fabrics/yarn. Preparation of dyeings using different hues and different depths on the following classes of dyes:

Direct dyes on cotton.
Reactive dyes on cotton.
Vat dyes on cotton.
Sulphur dyes on cotton.
Azoic dyes on cotton.
2. Effect of different parameters and auxiliaries on the above dyeing processes.
3. Stripping of dyed materials and re-dyeing.
4. After-treatments of dyed materials for improvement of fastness properties.
5. Shade matching of above dye classes.

Recommended Book:

1. Giles Laboratory Course in Dyeing by David G. Duff and Roy S. Sinclair, Fourth Edition, 1989. The Society of Dyers and Colorists, UK.

TCP-202**PRETREATMENT LAB****Credits: 0-0-3**

1. Desizing of cotton-acid Desizing, enzymatic Desizing, oxidative desizing, continuous desizing.
2. Desizing of synthetic fabrics and their blends
3. Evaluation of Desizing efficiency
4. Scouring of cotton yarn and cotton fabric - the lime-soda boil, the caustic soda boil, the soda-ash boil, the mixture of caustic soda and soda-ash boil, the soap/detergent-soda-ash boil methods. Emulsion scouring.
5. Evaluation of scouring efficiency by Cu number, Methylene blue absorption method and cupramonium fluidity method
6. Bleaching of cotton with NaOCl.
7. Effect of pH on the course of hypochlorite oxidation of cellulose.
8. Bleaching of cotton with per acetic acid.
9. Bleaching of cotton with sodium chlorite
10. Mercerization of cotton
11. Slack and tension mercerization.
12. Hot and cold merceriation
13. Effect of NaOH concentration, time and temperature on mercerization of cotton.
14. Effect of mercerization on dye uptake and other properties of cotton.
15. Determination of barium activity number of mercerized cotton
16. Scouring of raw wool
17. Chlorination of Wool.
18. Effect of chlorination on wool dye uptake and fastness properties.
19. Carbonization of wool.

B. TECH. (TEXTILE CHEMISTRY) SEMESTER-III
(Under Credit Based Continuous Evaluation Grading System)

20. Degumming of raw silk by different methods.
21. Reductive bleaching of wool with sodium bisulphate, sodium hydrosulphite, thio-urea etc
22. Bleaching of wool with Potassium Permanganate, H₂O₂.
23. Bleaching of nylon, cellulose acetate and acrylic with per acetic acid.
24. Bleaching of polyester, nylon with sodium chlorite
25. Bleaching of synthetic fibres and their blends with natural fibres
26. Effect of Heat setting on dye uptake of Polyester.

Texts:

1. Technology of Bleaching & Mercerization Vol. III by Dr. V.A. Shehnai Published by Sevak Publications
2. Textile Scouring & Bleaching by E.R. Trotman Published by B.I. Publications Pvt. Ltd., New Delhi
3. Chemical Technology in the Pre-treatment Processes of Textiles by S.R. Karmakar, Published by Elsevier Publications, The Netherlands.

TCL-205

WOOL DYEING TECHNOLOGY**Credits: 3-1-0****UNIT – I****1. Theoretical Basis of Wool Dyeing:**

Introduction, chemical composition of wool, dyes for wool, concept of dye aggregation, mechanism of dyeing using acid dyes, chemical modifications on wool and their impact on dye uptake of various classes of dyes. (5)

2. The Role of Auxiliaries in Wool Dyeing:

The surface-activity of wool-dyeing auxiliaries, Brightening agents, Levelling agents, Restraining and reserving agents, antiprecipitants, Wool protective agents, Low temperature dyeing, correction of faulty dyeings, aftertreatments to improve wet fastness, Antifrosting agents, Sequestering agents. (10)

UNIT – II**3. Dyeing of Wool with Acid and Chrome Dyes:**

Introduction, acid dyes, classification of acid dyes: leveling acid dyes, equalizing acid dyes, milling acid dyes, super-milling acid dyes, mordant dyes and application methods of all these dye types including dye-bath constitution and dyeing profiles, role of acid and Glauber salt in acid dye dye baths, theoretical basis of chrome dyeing, the chroming species, practical aspects of chrome dyeing viz. minimizing fabric damage, chromium in dye bath effluent, dye bath exhaustion, role of pH, interfering chemicals, Specific recommendations to reduce chromium levels. Mechanism of dye fibre interaction in acid dyes. (10)

4. Dyeing of Wool with Metal-complex Dyes:

Introduction, chemistry of ligands involved in dyes, chemistry of metal ions in metal complexes, 1:1 metal/dye complexes and 1:2 metal/dye complexes, weakly and strongly polar metal/dye complexes, their dyeing behavior, dye bath constitutions (exhaust as well as pad) and dyeing profiles, Mechanism of dye-fibre interaction in metal complex dyes. (10)

UNIT – III

5. **Dyeing wool with Reactive Dyes:**

Introduction about reactive dyes for wool, the chemistry of reactive dyes, nucleophilic substitution mechanism and Michael-addition mechanism, specific reactive dyes for wool, application procedures, dyeing processes for reactive dyes for wool, after treatments of dyeings, mechanism of dye fixation, novel processes for use with reactive dyes, effect of reactive dyes on fibre properties, novel reactive dyes for wool, identification of reactive sites in the fibre. (10)

6. **Wool Dyeing Machinery:**

Introduction, Principle of working, neat sketch describing principle of working of the machines and salient features of the application of the machines used in top dyeing, loose-stock dyeing, hank dyeing, package dyeing, Jig dyeing machines: Principle of Jig dyeing, Comparison of primitive and modern jigs, labeled sketch, the drive, the dye bath, heating mechanisms, top covers and their advantages, temperature controls, expanders, log rolls, sampling technique, unloading, modified jigs for handling velvets etc., defects in jig dyeing such as: listing, ending, tailing, watering marks, blanchiness and its remedies. Winch dyeing machines: Principle of winch dyeing, dyebath characteristics and construction, types of winches: deep-draught and shallow draught winches, winch reel, jockey roller, principle and mechanism of dyeing on winch in terms of dye uptake and exhaustion, heating, formation of bubbles in the dyebath and their condensation, peg-rail, salting box, concept of ballooning and its advantages, fabric ropes, covers, loading and unloading, spiral dyeing, high temperature winches. (15)

Recommended Book:

1. Wool Dyeing edited by David M. Lewis (1992 Edition). Chapters 2,6-8. The Dyers Company Publication Trust, distributed by The Society of Dyers and Colorists (SDC), UK.

TCL-206

PRETREATMENT TECHNOLOGY–II

Credits: 3-1-0

UNIT – I

1. Mercerization:

Introduction, process variables and their effect on properties of mercerized cotton, factors affecting lustre of mercerized cotton, tensile strength, swelling & solution. Effect of caustic conc. on shrinkage, changes occurring in physical structure of cellulose during and after mercerization, mercerizing wetting agents & requirements of a good mercerizing wetting agent. Assessment of degree of mercerization in terms of moisture regain and barium activity number, Yarn mercerizing machines, Fabric (Woven/Knitted) mercerizing machines-Pad chain type, chainless type & padless, chainless type, Mercerization of Blends, Continuous processing unit for slack mercerizing, Liquid Ammonia treatment, latest developments in the field.

UNIT – II

2. Wool Scouring

Yarn scouring, scouring of woven or knitted fabrics, testing of scoured wool, machinery used for wool scouring, Testing of scoured wool for residual grease and damage, wool carbonization and milling, bleaching of wool and effect of pH on whiteness and damage, assessment of wool damage in alkaline scouring and bleaching.

UNIT – III

3. Degumming of Silk

Conventional methods, enzymatic degumming.

4. Scouring and Bleaching of Man-Made Textiles.

Scouring and bleaching of blended textiles.

Texts:

- 1) Textile Scouring & Bleaching by E.R. Trotman, B.I. Publications Pvt. Ltd, New Delhi.
- 2) Technology of Bleaching & Mercerization Vol. III by Dr. V.A. Shenai, Published by Sevak Publications.
- 3) Chemical Technology in the Pre-treatment Processes of Textiles by S.R. Karmakar, Published by Elsevier Publications, The Netherlands.

TCL-207

PHYSICAL PROPERTIES OF TEXTILE FIBRES

Credits: 3-0-0

UNIT – I

1. Moisture and Fibre Properties:

Equilibrium Absorption of Water: definitions, relation between regain and relative humidity. Heats of Sorption: definitions, results, effects of evolution of heat. Rates of Absorption of Moisture: diffusion coefficients of fibre moisture, penetration of a dry fibre, conditioning of a mass of fibres, comparison with experimental results, the interaction of moisture and heat changes, practical effects. Swelling: introduction, measurement of swelling, results. Theories of Moisture Absorption: The General view (Introduction, the effect of hydrophilic groups, directly and indirectly attached water, absorption in crystalline and non-crystalline regions, hysteresis – a molecular explanation, quantitative theories of absorption.

2. Tensile Properties:

Factors determining the results of tensile experiments, expressing the results: quantities and units, experimental methods, results, fibre fracture morphology

3. Elastic Recovery:

Introduction, definitions, experimental methods, results, change of properties as result of straining: mechanical conditioning, swelling recovery, simple recovery models.

4. Time Effects:

The study of time dependence, creep: primary and secondary creep, influence of various factors on creep, relaxation of stress, fatigue, dynamic tests

UNIT – II

5. Forces in Various Directions:

Flexural rigidity, experimental results, bending stress-strain relations, torsional rigidity, results of torsional experiments, torsion and time, breaking twist, shear strength

6. Dielectric Properties:

Definitions of dielectric properties, the effect of frequency, the effect of moisture, the effect of temperature, the effect of other factors, summary of results for various materials

7. Optical Properties:

Refractive index and birefringence, birefringence and orientation, comparative values, absorption and dichroism, reflexion and luster

B. TECH. (TEXTILE CHEMISTRY) SEMESTER-IV
(Under Credit Based Continuous Evaluation Grading System)

8. Fibre Friction:

Technological effects, empirical results, the friction of wool: experimental

UNIT – III

9. Electrical Resistance:

Definitions, results of experiments, theoretical

10. Static Electricity:

Introduction, results, explanation of static phenomenon

11. Thermal Properties:

Thermal parameters, structural changes in fibres on heating, setting.

Book:

Physical Properties of Textile Fibres by W. E. Morton and J. W. S. Hearle, The Textile Institute.

MTL-222

APPLIED STAT AND STATISTICAL CONTROL

Credits: 3-0-0

UNIT – I

A general introduction about the role of statistics in science and technology, Classification and tabulation of frequency distribution, Diagrammatic and graphical representation of frequency distribution data, Measures of central tendency, dispersion, skewness and kurtosis. Correlation and regression analysis for bivariate data, partial and multiple correlations (for three variables only).

UNIT – II

An introduction to probability and random variables, Binomial, Poisson and Normal probability distributions, their definitions & important applications in the industry, Tests of hypothesis and level of significance, Random sample. χ^2 , t and Z tests: their applications in industry.

UNIT – III

Fitting of polynomials and growth curves (excluded derivations), growth rate, An introduction to control charts, 3σ control limits, Control charts for mean, proportion defective and number of defects per unit. (excluded derivations)

Recommended Books:

1. Fundamentals of Statistics by S.C. Gupta, Himalaya Publishing House.
2. Statistical Methods: An introductory text, by I. Medhi, New Age International Pvt. Ltd.
3. Fundamentals of Applied Statistics by S.C. Gupta & V.K. Kapoor, Sultan Chand & Sons Publishers.
4. Theory and problems of Elements of Statistics, Vol.-I, by Stephen Bernstein and Ruth Bernstein.
5. Mathematical Statistics with Application by Irwin Miller Marryless Miller, Pearson Education Publishers.

TCL-208

INTRODUCTION TO YARN MANUFACTURE

Credits: 3-1-0

UNIT – I

1. **General Introduction to Spinning:**
Fibre characteristics and spinnability (staple length, fibre denier, spinning limit, fibre strength, crimp, antistatic and antifriction fibre finish). Flow diagram of Cotton, woollen, worsted and semi- worsted systems of spinning (4)
2. **Blending:**
Objectives of blending: improved functional properties, improved process performance, economy, fancy effect, aesthetics, measures of blending: degree of blending, index of blend irregularity, migration, migration index, tinting, selection of blend constituents, type of fibres, compatibility of blend fibres (length & denier of fibres, extensibility, fibre density, dispersion properties, drafting properties, dyeing properties, blend ratio), mechanics of blending: blending at blowroom (feeder blending, stack blending, lap blending), blending at drawframe, relative merits and demerits of blending methods discussed above. (8)
3. **Blowroom:**
Introduction, conditioning of stock, sequence of blowroom machines, introduction to two and three bladed beater, kirschener beater, porcupine opener, crighton opener and SRRL opener. (3)

UNIT – II

4. **Carding:**
Objects of carding, card clothing: flat wire, cylinder wire (wire type, wire angle, wire-point density, wire height), doffer wire, licker-in wire, high production cards, speeds, settings: effect of fibre length, fibre denier, production, blend components. Nep removal and nep generation at carding. Sliver irregularity, autolevelling-objectives, short, medium and long-term irregularities, their causes and correction. (7)
5. **Draw Frame:**
Objects, blending at drawframe (number and hank of slivers, slivers' disposition), fleece blending at drawframe, drafting systems, draft distribution, sliver hank, roller settings, delivery speed, roller lapping: causes and remedies, principle of autolevelling at drawframe. (5)

UNIT – III

- 6. Speed Frame:**
Introduction, drafting systems, roller settings, spindle speed, roving twist, false twist attachments. General considerations about roller weighing, use of condensers, spacers and aprons, surface finish of machine parts, winding tension, bobbin taper, storage of bobbins, stop motions. (3)
- 7. Ring Spinning:**
Introduction, drafting systems, roller settings, modified drafting system with recessed apron top roller. Yarn twist, spindle speed, rings and travellers, yarn hairiness, end breaks, yarn quality. Common yarn faults: slubs, crackers or cockled yarn, neps, fluffy yarn, smoky yarn, Twist setting, waste, production. (5)
- 8. Spinning of Woollen and Worsted Yarns:**
Fibre specifications, process flow, general introduction to spinning machinery. (4)
- 9. Non Conventional Yarn Manufacturing:** An introduction to the principles of rotor spinning, air jet spinning, friction spinning and their comparative study of the three systems of open end spinning with respect to productivity and yarn quality. (6)

Texts:

- i).** Spinning of Man-made Fibres and Their Blends by Salhotra. (1993 Edition). Chapters (1-9). Published by Textile Association.
- ii).** Textiles, The Motivate Series. Chapter (7,8)
- iii).** Textiles Fibre to Fabric by Bernard P. Corbman. (Sixth Edition).Chapter (2). Published by McGraw Hill Book Company, New Delhi.

TCP-203

WOOL DYEING LAB

Credits: 0-0-3

1. Application of different classes of dyes on natural fibres/fabrics/yarn. Preparation of dyeings using different hues and different depths on the following classes of dyes:

Acid dyes on wool.

Mordant dyes on wool.

Metal complex dyes on wool.

Natural dyes on wool.

Reactive dyes on wool.

2. Effect of different parameters and auxiliaries on the above dyeing processes.
3. Stripping of dyed materials and re-dyeing.
4. After-treatments of dyed materials for improvement of fastness properties.
5. Shade matching of above dye classes.

Recommended Book:

Giles Laboratory Course in Dyeing by David G. Duff and Roy S. Sinclair, Fourth Edition, 1989.
The Society of Dyers and Colorists, UK.

B. TECH. (TEXTILE CHEMISTRY) SEMESTER-IV
(Under Credit Based Continuous Evaluation Grading System)

TCP-204

TEXTILE TESTING LAB (Physical)

Credits: 0-0-3

1. Fabric analysis: identification of warp and weft, of ends per inch, picks per inch, count and crimp of warp & weft and GSM of the fabric.
2. Weave analysis: determination of weave of the fabric, to draw point paper design of the weave along with the drafting, lifting and denting plan.
3. Analysis of knitted fabric for knit, wales & courses per inch, yarn count and crimp and fabric weight.
4. To determine the wash fastness of the dyed fabric to machine wash.
5. To determine fastness to water of the dyed fabric.
6. To determine the fastness of the dyed fabric to acidic and alkaline perspiration
7. To determine sublimation fastness of the dyed fabric
8. To determine dry & wet rubbing fastness of the dyed fabric.
9. To determine fastness of dyed fabric against direct sunlight.
10. To determine the pilling resistance of the fabric by ICI Pill-Box method.
11. To determine the abrasion resistance and pilling tendency of the fabric by Martindale abrasion tester.
12. To study the difference between sample-to-sample and sample to standard abrasion of fabrics on Martindale abrasion tester
13. To study the effect of increase in pressure on the extent of sample-to-sample abrasion obtained on Martindale abrasion tester.
14. To study the effect of increase in pressure on the extent of sample-to-standard abrasion obtained on Martindale abrasion tester.
15. To determine the tensile strength of the fabric- warp & weft ways.
16. To study the effect of change in length of the specimen on the tensile strength of the fabric (both warp & weft ways)

Texts:

1. Principles of Textile Testing by J.E. Booth
2. IWS Testing Manuals
3. Handbook of Textile Testing by Grover & Hamby

Interdisciplinary Course – III

Interdisciplinary Course – IV

TCL-301

SYNTHETIC DYEING TECHNOLOGY**Credits: 3-1-0****UNIT – I****1. Machines for Dyeing Synthetics:**

The thermosol method. The pad-roll system. Pressure beam dyeing machines: Principle of pressure beam dyeing, precautions and method of beam making, beam loading, heating and cooling, main pump, liquor circulation, sequence of steps involved in beam dyeing and factors controlling dyeing. Jet dyeing and soft-flow machines: The Gaston county machine, advantages over winch dyeing machine, fully flooded jet machines, low liquor ration reel-jet dyeing machines. (15)

2. Technology of Acrylic Dyeing:

Introduction, use of cationic dyes, thermodynamics of dye-adsorption, kinetics of dye adsorption, effect of pH, electrolyte and temperature of dye adsorption, effect of water on PAN fibres, Carrier dyeing, Retarding agents in acrylic dyeing, dye-fibre characteristics, Migrating cationic dyes, Gel dyeing, Dyeing of acrylic using disperse dyes: thermodynamics, kinetics and general considerations. (15)

UNIT – II**3. Technology of Polyester Dyeing:**

Introduction, Use of disperse dyes: effect of crystal form of the dye of dye adsorption, effect of particle size and distribution on dye adsorption, effect of dispersing agents on dye adsorption, effect of leveling agents on dye adsorption, effect of temperature on dye adsorption, isomorphism, oligomers, carrier dyeing, solvent assisted dyeing, solvent dyeing, high temperature dyeing, thermofixaion and after clearing. Use of Azoic and vat colorants on polyester. (15)

UNIT – III**4. Technology of Nylon Dyeing:**

Introduction, Use of anionic dyes: Barre effects, Acid dyes, mordant dyes, direct dyes and reactive dyes. Use of cationic dyes. Use of non-ionic dyes viz. disperse dyes, disperse reactive dyes, azoic colorants and vat dyes. (15)

Text Books:

1. Engineering in Textile Coloration Edited by C. Duckworth (1983 Edition), Chapter–1 Pages 1-68. The Dyers Company Publication Trust, Distributed by The Society of Dyers and Colorists (SDC), UK.
2. Chemical Principles of Synthetic Fibre Dyeing by S.M. Burkinshaw (1995 Edition). Blackie Academic and Professional (Chapman and Hall), UK.

TCL-302

PRINTING TECHNOLOGY-I**Credits: 3-1-0****UNIT – I****1. Traditional Methods:**

Block printing, engraved copper printing, surface printing and engraved roller printing. (5)

2. Screen-printing:

Hand screen printing, semi-automatic and fully automatic screen printing, rotary screen printing. Design aspects: design selection, repeat sketch, colour separation, step and repeat. Screen production: the photochemical process, flat screens, rotary screens. half-tone and multi-tone printing, laser engraving.

(10)

UNIT – II**3. Transfer Printing:**

Sublimation transfer, selection of paper, printing methods, dyes and inks, the mechanism of sublimation transfer, sublimation transfer on natural fibres. Melt transfer printing, film release transfer printing, wet transfer printing. The fundamental mechanism of screen printing. Carpet printing: the stalivart machine, flat screen printing machines, rotary screen printing machines, spray and jet printing machines, foam printing. (15)

UNIT – III**4. Direct Print Coloration:**

Pigment Printing: Pigment dispersions, binder systems, thickening systems, pigment printing pastes, advantages and limitations of pigment printing. Pigment printing of polyester / cotton blend. Printing of Cellulosic fibres, printing of polyester/cotton blend with a mixture of dyes: Disperse and reactive dyes, disperse and vat dye, special brands of dyes. Printing of polyester fibres, cellulose acetate fibres, acrylic fibres, polyamide fibres, protein fibres. (20)

5. Azoic Colour Printing:

Introduction. Methods of printing: base printing method: Naphthol printing method: Naphthol Nitrite Padding Method: Naphthol Nitrite Printing Method: Fast Bases. (10)

Text Book:

Textile Printing Edited by Leslie W.C. Miles (1994 Edition). Chapters (1-8). Published by Society of Dyers and Colourists, Bradford.

TCL-303

FINISHING TECHNOLOGY-I

Credits: 3-1-0

UNIT – I

1. Introduction to Finishing:

Wet and dry or chemical or mechanical finishing, application of chemical finishes, drying wet textiles, curing chemical finishes, Calendaring, Emerising, Raising, crepe, linen beetling, compressive shrinkage. (10)

2. Application Methods:

Dip and nip padding, the padding mangle, low wet pick-up application methods, saturation removal methods, spray application systems, foam application methods, comparison of low wet pick up methods, wet on wet application. (5)

UNIT – II

3. Stenters:

Pin and clip stenters rails, fabric entry into stenter, drive system, fabric delivery, heating in stenters, hot flues, contact heating, perforated suction drums, continuous steamers for dye fixation. (5)

4. Hand Building Finishes:

Introduction, the hand building effect, examples of textiles with hand building finishes, typical hand builder chemistry, evaluation methods, trouble shooting (8)

5. Softening Finishes:

Mechanism of the softening effect, cationic softeners, amphoteric soft finishes, non-ionic soft finishes, anionic soft finishes, reactive soft finishes, silicones, typical softened textile articles, product types and their chemistry, compatibility and combinability, evaluation and testing. (8)

UNIT – III

6. Easy care and Durable Press Finishing of Cellulosics:

Introduction, easy care properties, easy care technology, mechanism of easy care and durable press finishing, chemistry of easy care and durable press finishes, application methods, formaldehyde free easy care finishes, compatibility with other finishes, evaluation methods. (9)

B. TECH. (TEXTILE CHEMISTRY) SEMESTER-V
(Under Credit Based Continuous Evaluation Grading System)

7. Finishing of Woolen Textiles: Shrinkage Control and Mechanical Finishing:

Setting, Decatizing, Milling, fulling and fabric development, cropping/shearing, fabric conditioning, raising/teaseling, pressing, relaxing/sponging/shrinking, Felting and shrinkage – the dimensional stability problem, measurement of shrinkage- equipment and procedures, shrinkage prevention and control, processing – the issues and options, additional aspects, commercial process routes. (15)

Text Books:

1. Textile Finishing, (Ed.) Derek Heywood Society of Dyers and Colorists, 2003.
2. Chemical Finishing of Textiles, by W.D. Schindler and P.J. Hauser, Woodhead Publishing Ltd, Aug 2004.
3. Handbook of Fiber Science and Technology: Volume–II, Chemical Processing of Fibers and Fabrics Functional Finishes Part–A and Part–B, Edited by Menachem Lewin and Stephen B. Sello.

TCL-304

TEXTILE TESTING-II

Credits: 3-1-0

UNIT – I

1. Fabric Dimensions:

Measurement of fabric length, width, thickness, and fabric weight per unit area and per unit length. Threads per inch in woven fabric, crimp of yarn in fabric, definition, crimp and fabric properties, the measurement of crimp percentage. The W.I.R.A. crimp tester. Textile structure- yarn count, diameter and cloth cover, cover factor and its relation to fabric weight per unit area, crimp, count and cloth setting, crimp, crimp amplitude, cloth setting and cloth thickness. (6)

2. Fabric Properties:

Definition of air permeability, air resistance and air porosity, and measurement of air permeability, air permeability and fabric properties. Thermal properties of fabric, fabric stiffness, drape and handle. The ‘Shirley’ stiffness tester, bending length, flexural rigidity and bending modulus. The ‘Heart loop’ test, drape meter, crease resistance and crease recovery, measurement of crease recovery by ‘Shirley Crease Recovery tester’. (8)

UNIT – II

3. Serviceability, Wear and Abrasion Resistance:

Purpose of serviceability testing-abrasion and wear, flat, edge and flex abrasion. Testing of abrasion resistance conditioning of specimen, choice of testing instrument, choice of abradant, abrasion motion and direction of abrasion, backing the specimen, end point of test and assessment of abrasion damage. The B.F.T. abrasion testing machine, the pilling of fabrics, I.C.I. pilling box test and Martindale abrasion tester. Flammability-definitions, factors affecting flame resistance. (8)

4. Water and Fabric Relationships:

Waterproof, Shower-proof and Water-repellent fabrics, wettability. Methods of testing – wetting time test, spray test, drop penetration test, Bundesmann test. The penetration of fabrics by water under pressure, the ‘Shirley Hydrostatic Head’ test, the water percolation test, sinking test, wetting by wicking test. Shrinkage test-relaxation and felting shrinkage, testing for shrinkage, percentage shrinkage. (8)

UNIT – III

5. **The Tensile Testing of Textiles:**

Definitions, load, breaking load, stress, mass stress, tenacity or specific stress, breaking length, strain, extension, breaking extension, the load-elongation curve, the stress-strain curve, initial Young's modulus, Yield point. 'Work of Rupture', Work factor, Elastic recovery, instantaneous and time dependent effects, loading the specimen beyond the yield point, some factors affecting the tensile properties of textiles and the results obtained from testing instruments. (10)

6. **Application of Load and Elongation to Textile Specimen:**

CRE, CRL, CRT and CR Stress methods of loading, the Pendulum lever principle with CRT, Stelometer, Balance principle, Pressley fibre bundle strength tester, the inclined plane principle, the Scott I.P. tester, the 'Uster' yarn strength tester, the Ballistic or impact tester. The Strain-gauge principle, advantages and disadvantages of strain-gauge instruments, the 'Instron' tensile testing instrument, yarn strength testing- lea test, C.S.P. skein breaking tenacity, single thread test. Fabric Strength testing- objectives, the hydraulic bursting strength tester, the strip and Grab test, tearing strength, methods of measuring tearing strength- tongue tear test, the tongue double rip tear test, the trapezoid test, the wing-rip tear test, the ballistic tear test, the Elmendorf tearing tester. (10)

7. **Evenness Testing**

Random and periodic variations, short, medium and long term variations, index of irregularity, limit irregularity, reduction of irregularity by doubling, electronic capacitance evenness testing- the 'Uster Evenness tester', material speed, chart speed and chart contraction, the choice of measuring capacitor, normal and inert testing, imperfection indicator, photoelectric tester, nep counting and nepping potential. (10)

Text Book:

Principles of Textile Testing by J.E. Booth Published by CBS Publishing Company, New Delhi.

TCL-305

INTRODUCTION TO FABRIC MANUFACTURE**Credits: 3-1-0****UNIT – I****1. Clearing, Doubling and Winding:**

Objects of clearing, doubling and winding. Twist and twist direction effects, Z on Z Vs Z on S twists balanced and unbalanced yarns, ply, cord and cable yarns, resultant count calculation for ply & cord yarns. Fancy yarns- definition of Boucle, gimp and loop yarns, eccentric or slub gimp yarns, snarl yarn, knop yarn, spiral or corkscrew yarn, chenille yarn, slub yarn, cloud yarn and flock yarn. Introduction to mechanical & electronic yarn clearers, doubling machines (Ring Doubler and TFO) and their comparison. Introduction to autoconer. General introduction to various methods of fabric manufacturing (woven, knitted, braided, lace and net fabrics, felts and non-wovens). (10)

2. Weaving Preparatory:

Warping and sizing-their objects and machines for the same. (10)

UNIT – II**3. Weaving:**

Primary, secondary and auxiliary motions of a loom, types of shuttle and shuttleless looms, definition of bottom closed, center closed, semi-open and open shed. (10)

4. Fabric Construction and Design:

Construction of cloth design, classification of weaves (plain weave, twill weave, satin and sateen weave and their derivatives-ribbed effects, mock rib, matt weave, waved twills, herringbone twill, elongated twill, diamond weave) crepe weave, stripe & check effects, lappet, swivel, gauze & leno weaves, pile fabrics-cut & uncut – terry, velvet and corduroy fabrics, combination of two weaves, types of selvages. (10)

UNIT – III**5. Knitting:**

Introduction, advantages and disadvantages of knitted fabrics over woven fabrics. Knitting stitches (plain stitch, purl stitch, miss stitch and tuck stitch). Classification of knitted fabrics (weft knit, warp knits). Classification of weft knitted fabrics – plain, rib purl and interlock knit fabrics, Warp knitted fabrics. Defects in knitted fabrics, knits in use, advantages and disadvantages of specified knitted fabric types, weft insertion knits and their advantages. (10)

B. TECH. (TEXTILE CHEMISTRY) SEMESTER-V
(Under Credit Based Continuous Evaluation Grading System)

6. Felts and Non-Woven:

Definition, dry and wet laid webs, spun and melt blown webs, parallel, cross and random laid webs, adhesive bonding, needle punched fabrics, stitch-bonded fabrics, thermally bonded fabrics, reinforced felts, nonwovens in use. Fabrics formed from non-fibrous materials. (10)

Text Books:

1. Textiles – Fibre to Fabric by Bernard P. Corbman (Latest Edition) Chapter 4, Published by McGraw Hill Book Company, New Delhi.
2. Textiles by A. Wyne–The Motivate Series, Published by Macmillan, Hongkong.

B. TECH. (TEXTILE CHEMISTRY) SEMESTER-V
(Under Credit Based Continuous Evaluation Grading System)

TCP-301

SYNTHETIC DYEING LAB

Credits: 0-0-3

1. Application of different classes of dyes on synthetic fibres/fabrics/yarn. Preparation of dyeing using different hues and different depths on the following classes of dyes.
2. Basic dyes on acrylic.
3. Disperse dyes on Polyester.
4. Acid and metal complex dyes on nylon.
5. Effect of different parameters and auxiliaries on the above dyeing processes.
6. Stripping of dyed materials and re-dyeing.
7. Shade matching of above dye classes.
8. Determination of washing fastness of dyes of the above dye classes.

Text Book:

Giles Laboratory Course in Dyeing by David G. Duff and Roy S. Sinclair, Fourth Edition, 1989.
The Society of Dyers and Colorists, UK.

B. TECH. (TEXTILE CHEMISTRY) SEMESTER-V
(Under Credit Based Continuous Evaluation Grading System)

TCP-302

PRINTING LAB-I

Credits: 0-0-2

1. Printing of cotton with Direct, Reactive, Vat, sulphur dyes & pigments.
2. Printing of wool with acid & metal complex dyes.
3. Printing of polyester with disperse dyes & pigments.
4. Printing of various blends e.g. polyester/cotton, polyester/wool and other available blends.
5. Printing of textile fabrics with different styles of printing i.e. Direct, discharge & resist.

Text Books:

1. Textile Printing edited by Leslie W. C. Miles (1994 edition).
2. An introduction to Textile Printing by W. Clarke, Newnes - Butterworths.

Reference:

The Thames & Hudson Manual of Textile printing by Joyee Storey. (1974 Edition).

TCP-303**CCM LAB****Credits: 0-0-3**

1. Calibration of spectrophotometer.
2. Measurement of colour using spectrophotometer.
3. Measurement of reflectance and its conversion into K/S values.
4. Colorimetric determination of single component and mixture (two components) of dyes in solution.
5. Validation of Lambert-Beer Law and determination of unknown concentrations.
6. Preparation of dye data bases and their recording/storing in CCM.
7. Determination of dye strength after dyeing.
8. Comparison of dye strength after dyeing.
9. Determination of whiteness index.
10. Determination yellowness index.
11. Recipe formulation of unknown shades.
12. Evaluation of color related properties such as metamerism, color constancy.
13. Evaluation of color difference.

Text Books:

1. Color Physics for Industry by Roderick McDonald, Second Edition, 1987, Society of Dyers and Colourists, UK
2. Instrumental Color Measurement and Computer Aided Color Matching for Textile by H.S. Shah and R.S. Gandhi (1990 Edition), Mahajan Book Distributors, Ahmedabad.

TCL-306

BLENDS DYEING TECHNOLOGY**Credits: 3-0-0****UNIT – I****1. Why blending is necessary?**

Blending from dyer's viewpoint, composition of blend fabrics, relative importance of individual blends, reasons for development of fibre blends, color effects achieved by blending. (5)

2. Classification of fibre types and their blends:

Classification of fiber types in terms of dyeability, colour distribution attainable on binary blends. (3)

3. Dynamic competition between fiber types in the dyeing of blends:

Introduction, distribution of acid dyes on nylon/wool blends, nylon/polyurethane blends, cross-staining of wool by disperse dyes and basic dyes, the transfer of disperse dyes during thermofixation of polyester/cellulosics blends. (5)

4. Minimizing incompatibility between dyes from different classes:

Interaction between disperse dyes and reactive dyes, interaction between disperse dyes, vat dyes and basic dyes, interaction between anionic dyes and basic dyes. (5)

UNIT – II**5. Principles of design and coloring of differential dyeing methods:**

Design of differential- dyeing variant synthetic-polymer yarns, Dyeing of acid-dyeable nylon variants, Dyeing of acid-dyeable/basic-dyeable nylon variants, design of differential-dyeing cellulosic fabrics, Design of differential-dyeing wool keratin derivatives. (2)

6. Nylon/wool and other AA blends:

Dyeing of nylon/wool blends, Blends of wool with other acid-dyeable fibres, Blends of nylon with other acid-dyeable fibres, Dyeing methods and dye selection for AA blends. (2)

7. Wool/acrylic and other AB blends:

Dyeing of wool/acrylic blends, Dyeing of nylon/acrylic blends, Blends of acid-dyeable and basic-dyeable acrylic variants, Blends of modacrylic and acrylic fibres, Blends of amide fibres with modacrylic or acid-dyeable acrylic variants, Blends of basic-dyeable polyester with wool or nylon, Dyeing methods and dye selection for AB blends. (2)

8. Wool/ cellulosic and other AC blends:

Dyeing of wool/cellulosic blends, Exhaust dyeing of nylon/cellulosic blends, Continuous dyeing of nylon/cellulosic blends, Dyeing methods and selection for AC blends. (3)

B. TECH. (TEXTILE CHEMISTRY) SEMESTER-VI
(Under Credit Based Continuous Evaluation Grading System)

9. Cellulosic/ acrylic and other CB blends:

Exhaust dyeing of cellulose/ acrylic blends, Continuous dyeing of cellulosic/ acrylic blends, Blends of cellulosic fibres with modacrylic or acid-dyeable acrylic variants, Blends of basic-dyeable polyester with cotton, Dyeing methods and dye selection for CB blends. (3)

10. Cotton/viscose and other CC blends:

Properties and performance of cellulosic fibres in their blends, Dyeing behavior of cellulosic fibres in their blends, Dyeing methods and dye selection for CC blends. (4)

11. Polyester/ wool and other DA blends:

Dyeing of polyester/ wool blends, Blends of cellulose acetate or triacetate with wool, Dyeing of polyester/ nylon blend, Blends of cellulose acetate or triacetate with nylon, Blends of poly(vinyl chloride) fibres with wool or nylon, Dyeing methods and dye selection for DA blends. (3)

UNIT – III

12. Polyester/ acrylic and other DB blends:

Dyeing of polyester/ acrylic blends, Blends of cellulose acetate or triacetate with acrylic fibres, Dyeing of normal/basic-dyeable polyester blends, Dyeing methods and dye selection for DB blends. (5)

13. Polyester/ cellulosic and other DC blends:

Exhaust dyeing of polyester/ cellulosic blends, Continuous dyeing of polyester/ cellulosic blends, Blends of cellulose acetate or triacetate with cellulosic fibres, Blends of poly(vinyl chloride) fibres with cellulosic fibres, Dyeing methods and dye selection for DC blends. (5)

14. Triacetate/ Polyester and other DD blends

Dyeing properties of disperse-dyeable fibre blends, Dyeing methods and dye selection for DD blends. (5)

15. Dyeing properties of three-component blends

Dyeing of AAA blends, Dyeing of AAB blends, Dyeing of AAC blends, Dyeing of CBA blends, Dyeing of DAA blends, Dyeing of DAC blends, Dyeing of DBA blends, Dyeing of DBC blends, Dyeing of DDA blends, Dyeing of DDC blends, Dyeing methods and dye selection for three component blends. (8)

Text Book:

Blends Dyeing Edited by John Shore (1998 Edition). Chapters 1-15. The Society of Dyers and Colorists (SDC), UK.

TCL-307**PRINTING TECHNOLOGY-II****Credits: 3-0-0****UNIT – I****1. Discharge printing:**

Print pastes for discharge printing, problems in discharge printing, application procedures in discharge printing: vat discharges on cellulosic fibres, pigment illuminated discharges, discharges on wool and silk, discharges on secondary cellulose acetate and cellulose triacetate, discharge and discharge-resist processes on polyester fibre, discharges on nylon, acrylic fibres and polyester cellulose blends. (15)

UNIT – II**2. Resist printing:**

Resists under aniline black, resists under reactive dyes, vat resists under vat dyed grounds, resists under azoic colorants, resist printing of wool. (10)

3. Special styles: Africa prints, bleeder styles, crimp style and burnt- out styles. (10)**UNIT – III****4. The production and properties of printing pastes:**

The requirements, Thickeners, raw materials: Polysaccharides, viscous emulsions, synthetic-polymer thickeners, Print paste rheology, Print paste production, color shop organization. (15)

5. Fixation and after treatment processes:

Fixation of pigment prints, Steamers: batch and continuous steamers, mechanism of fixation processes, dye fixation in steam, high temperature steaming, miscellaneous techniques. Washing - off processes, Washing- off equipment. (10)

Text Books:

1. Textile Printing Edited by Leslie W.C. Miles (1994 Edition). Chapters (1-8).
Published by Society of Dyers and Colourists, Bradford.
2. An Introduction to Textile Printing by W. Clarke, Newnes-Butterworths.

TCL-308

FINISHING TECHNOLOGY-II

Credits: 3-0-0

UNIT – I

1. Water Repellency and Waterproofing:

Introduction, theory of wetting and repellency, fabric construction and preparation for water repellent finishing, water repellent finishes other than fluorochemicals, fluorochemical repellent finishes, repellent finishes, novel treatments with potential for water, oil, soil and stain repellency, waterproofing of textiles, test methods for water repellency, oil repellency and stain resistance (10)

2. Flame Retardant Finishes:

Introduction, hazards of burning textiles, burning and flame retardancy, Mechanisms of flame retardancy, Flame retardant chemistry, Flame retardants for cellulose, Flame retardants for wool, Flame retardants for polyester, Flame retardants for nylon, Flame retardants for other fibres, Flame retarding fibre blends, Novel approach to flame retardancy: Intumescent, Evaluation of flame retardants. (10)

UNIT – II

3. Anti-static and Soil Release Finishes:

Mechanism of antistatic finishes, chemistry of antistatic finishes, conductive fibres, evaluation of antistatic finishes, mechanism of soil release, soil-release chemistry, evaluation of soil release. (7)

4. Antimicrobial Finishes:

Introduction, properties of an effective antimicrobial finish, Mechanisms of antimicrobial finishes, Chemistry of antimicrobial finishes, Evaluation of antimicrobial finishes. (5)

5. Insect Resist and Mite Protection Finishes:

Application of insect resist finishes, Evaluation of insect resist finishes troubleshooting insect resist finishes- Finishes for protection from dust mites, References (10)

UNIT – III

6. Ultraviolet Protection Finishes:

Introduction, Mechanism of UV protection, Chemistry of UV protection finishes, Evaluation of UV protection finishes, Troubleshooting UV protection finishes and combinability (5)

7. Finishing with Enzymes: Bio-finishes for Cellulose:

Introduction, Action of cellulase enzymes on cellulose, Chemistry of enzyme finishing, Evaluation of bio-finishing, Troubleshooting bio-finishing (5)

8. Coating Laminating, Bonding, Flocking and Prepegging:

Introduction, application of coated fabrics, coating compounds, coating methods and machines, new technological developments in the laminating market, bonding, flocking, prepegging, ovens, environmental considerations, test methods. (8)

Text Books:

- i) Chemical Finishing of Textiles, by W.D. Schindler and P.J. Hauser, Woodhead Publishing Ltd, Aug 2004.
- ii) Textile Finishing, (Ed.) Derek Heywood, Society of Dyers and Colorists, 2003.
- iii) Handbook of Fiber Science and Technology: Volume–II, Chemical Processing of Fibres and Fabrics Functional Finishes Part–A and Part–B, Edited by Menachem Lewin and Stephen B. Sello.

TCL-309 QUALITY & PROCESS CONTROL IN TEXTILE WET PROCESSING

Credits: 3-0-0

UNIT – I

1. Introduction:

Introduction about process control, important functions of a control laboratory in a modern processing house, Major areas of process and quality control in textile wet processing, schematic guidelines for process control in various processing sections. (5)

2. Measures for the important process control operations in textile wet processing:

Inspection of grey fabric, bleaching and mercerizing: desizing, scouring, bleaching (hypochlorite bleaching, H₂O₂ bleaching, Chlorite bleaching), Scouring, mercerizing, drying, Test methods for the determination of concentration of caustic soda and silica in peroxide bleach bath.

- Quality and Process control in Dyeing: General, Quality and Process control in jigger dyeing, package dyeing, continuous dyeing etc.

- Quality and Process control in Printing: General, Tests for the suitability of thickener in the print paste formulation and other concepts.

- Quality and Process control in Finishing: Optimization of finishing parameters to impart various finishes on different fibres. (20)

UNIT – II

3. Process parameters, process modification, any other changes, change in quality due to selection of impure chemicals/faulty fabrics/machine handling. (10)

4. Analysis of various chemical processing steps in terms of process and quality control. Methods to assess quality of processed product after every stage of processing and that of final product. (10)

UNIT – III

5. Standardization of instruments/machines. Analysis of colour to check impurity percentage, evaluation of chemicals to check their efficiencies. (10)

6. Control measures of garment processing. (5)

Text Book:

Process & Quality Control in Chemical Processing – ATIRA Tablet.

TCL-310

HIGH-TECH APPLICATION OF DYES

Credits: 3-0-0

UNIT – I

Hi-tech applications based on optoelectronics, such as dye sensitized solar cells, chemosensors, photochromic materials, liquid crystal displays, and the newer emissive displays such as organic light emitting devices; electronic materials, such as organic semiconductors;

UNIT – II

Imaging technologies, such as electrophotography (photocopying and laser printing), thermal printing, and especially ink-jet printing;

UNIT – III

“Invisible” imaging by using infrared absorbers in optical data storage, computer-to-plate and security printing.

Books:

1. Z. Yoshida and T. Kitao, *Chemistry of Functional Dyes*, Mita Press, Tokyo, Japan, 1989.
2. S.H. Kim, *Functional Dyes*, Elsevier, Amsterdam, 2006.

References:

1. A. Hagfeldt and M. Gratzel, “Molecular Photovoltaics,” *Accounts of Chemical Research*, Vol. 2000, 33, 269.
2. R. M. El-Shishtawy, “Functional Dyes” and Some Hi-Tech Applications, *International Journal of Photoenergy*, 2009, 1-21.

B. TECH. (TEXTILE CHEMISTRY) SEMESTER-VI
(Under Credit Based Continuous Evaluation Grading System)

TCL-311 TEXTILE TESTING STANDARDS/REGULATIONS

Credits: 3-0-0

UNIT – I

Textile testing as an instrument of process improvement and quality upgradation, review of cotton fibre testing methods-High Volume Instruments, testing foreign fiber contamination in cotton, raw silk testing methods-visual examination, winding test, size test, seriplane and serigraph test, cohesion test and conditioned size test, degradation measurements of linen fabric

UNIT – II

ISO standards and regulations for quality: Introduction, ISO 9000 quality standards, benefits of ISO 9000 registration, registration process, associations for standards, regulations and specifications.

UNIT – III

Fabric quality evaluation by objective measurement: Kawabata and FAST systems of testing: Fabric Assurance by Simple Testing (FAST 1,2,3,4 tests), Oko-tex standards and certification procedure. Objective evaluation of silk fabrics.

Books:

1. Nadiger G.S. & Subramanian S., "Testing as An Instrument for Process Improvement and Quality Upgradation", Asian Textile Journal, February-March 2002, page 59-62.
2. Itagi A A, "Raw Silk Testing Methods", Asian Textile Journal, February-March 2002, page 69-75.
3. Rane G.P., Panse V.C. & Choudhary R.B., "Siro FAST in RMG", Proceeding of Developments in Testing Instruments – Workshop at IIT Delhi, September 2002, page 156-162.
4. Lal MB & Iyer KRK, "Cotton Fibre Testing–New Indices and New Challenges", Asian Textile Journal, March 2003, pg 32-34.
5. Giri C C , "Okotex: A Holistic Approach for Textile Testing", Colourage, May 2003, page 49.
6. Micheal M.N., Tera F.M. & Othman E.M., "Degradation Measurements of Linen Fabrics" Colourage, June 2004, page 39.
7. Wellington Sears Handbook of Technical Textiles by Sabit Adanur, page 747-754, (Chapter 23 Standards and Regulations)

TCL-312 RECENT TRENDS IN PRINTING & GARMENT PROCESSING

Credits: 3-0-0

UNIT – I

A new millennium of textile printing, Introduction, market trends, pre-print procedures, print design, print paste preparation, fabric preparation, screen making. Printing machinery developments: flat-screen machines, rotary-screen machine, digital printing systems, Direct printing styles: pigments reactive dyes on cellulosic fibres, vat dyes on cotton, Transfer printing, Special printing styles, Printing thickeners and rheological studies, Developments in dyes for printing, After treatment of prints, Environmental considerations.

UNIT – II

Digital Printing-Trends & Technique. Introduction, Trends in use of textile printing machines, Merits of digitalization, Inkjet printing, Continuous stream printing, Drop-on-demand, Bubble jet, Valve jet, machinery range in digital printing.

UNIT – III

Spray applications of direct fixing colour on garment. Introduction, Important Features, Application on garment: Direct application on garment, discharge and DPDF colour application, one step discharge/DPDF colour application on denim.

(Current trends in garment processing. Traditional garment processing, Current garment processing, dyeing processes Dyeing machinery, Finishing processes, Finishing machinery, Advantages and disadvantages of garment dyeing, The future of garment processing.

Quality control in the apparel sector. Quality parameters in textiles, quality requirements, care labeling, colorfastness tests, dimensional stability, drying processes employed, flammability, quality norms and the Indian industry

References: The journal articles published during past ten years only.

TCL-313

BIO-PROCESSING OF TEXTILES**Credits: 3-0-0****UNIT – I****Introduction :**

Introduction to enzymes, Classification and nomenclature of enzymes, models of enzyme action, area of application in textile processing.

Bio-Preparation:**Cotton:**

Desizing: Recent developments in desizing process.

Scouring: use of pectinases, proteases, lipases, cutinases and cellulases for scouring, recipes and effect of process condition like pH, temperature, surfactant type and mechanical agitation on scouring efficiency.

Bleaching: Use of oxidoreductases in bleaching processes. Recipes and effect of process condition like pH, temperature.

UNIT – II

Combined processing of desizing, scouring and bleaching with enzymes

Advantages and disadvantages over conventional process of desizing, scouring and bleaching.

Protein fibers

Descaling and bio-carbonization of wool, degumming of silk

UNIT – III**Synthetic fibers**

Pretreatment of synthetic fibers with enzymes

Bio-Dyeing

Reduction of indigo dyes with enzymes, use of enzymes in washing process

References:

1. “*Textile Processing with Enzymes*”; Edited by A. Cavaco-Paulo and G. M. Gübitz, Woodhead Publishing Limited.
2. “*Bio-preparation of Cotton Fabrics*” Tzanko Tzanov, Margarita Calafell, George M. Guebitz, Artur Cavaco-Paulo; *Enzyme and Microbial Technology* 29 (2001) 357–362
3. “*Combined Bio-carbonization and Dyeing of Wool: A Possibility of Using Cell Wall-Degrading Enzymes and 1:1 Metal–Complex Dyes*”; I. C. Gouveia; J. M. Fiadeiro; J. A. Queiroz; *Eng. Life Sci.* 2008, 8, No. 3, 250–259
4. “*Optimization of Papain Treatment for Improving The Hydrophilicity of Polyester Fabrics*”; Hye Rim Kim and Wha Soon Song; *Fibers and Polymers* 2010, Vol.11, No.1, 67-71

B. TECH. (TEXTILE CHEMISTRY) SEMESTER-VI
(Under Credit Based Continuous Evaluation Grading System)

TCL-314

TECHNICAL TEXTILES**Credits: 3-0-0****UNIT – I**

Introduction: Definition and scope for technical textiles, History of technical textiles, present and future status of technical textiles, application areas of technical textiles. (3)

Coating and lamination textiles: Introduction, Chemistry of coated textiles, Material used for coating, substrate used for coating, Methods of coating, Physical properties of coated textiles and application of coated textiles. (3)

Textile reinforced composite materials: Introduction to composite material, Textile reinforced structure, Woven structure, knitted, braided and its application in different areas. (4)

Filtration textiles: introduction, theory of dust collection and solid-liquid separation, filtration requirements, concept of pore size and particle size, role of fiber, fabric construction and finishing treatments. (8)

UNIT – II

Geotextiles: Brief idea about geosynthetics and their uses, essential properties of geotextiles, geotextile testing and evaluation, application examples of geotextiles. (7)

Medical textiles: introduction, classification of medical textiles, description and basic requirements of material used for medical textiles. (6)

Protective Clothing: Brief idea about different type of protective clothing, functional requirement of textiles in defense including ballistic protection materials, thermal insulation, Biological and chemical warfare protection, water proof breathable fabrics and high attitude fabrics.(6)

Sports and recreation textiles: Functional requirement of different type of product and their construction. Application areas like Synthetic turfs, sports equipments, accessories and apparel.(6)

UNIT – III

Automotive Textiles: Application of textiles in automobiles, requirement and design for different tyres, airbags and belts, methods of production and properties of textiles used in these applications like railways, aeroplane, marine etc. (7)

Sewing threads, cords and ropes: Types, method of production and applications, functional requirements, structure and properties and application like parachute and bridge. (4)

Other uses of technical textile: Functional requirements and types of textiles used for paper making, agricultural, Sound insulation electronics, power transmission belting, hoses, canvas covers and tarpaulins. (6)

Book Recommended:

“Handbook of Technical Textiles”, Ed., A.R. Horrocks and S.C. Anand, Woodhead Publication Ltd., Cambridge.

TCP-304**BLENDS DYEING LAB****Credits: 0-0-3**

1. To conduct dyeing of all available blends of textile fibres such as cotton, viscose, polyester, wool, nylon, acrylic, silk, lycra.
2. To apply all possible dyeing methods such as single bath dyeing of two components as well as two bath-two stage yeing of two components of a blend.
3. To optimise the dyeing parameters w.r.t temperature, time, role of auxiliaries etc.
4. To develop all possible shade types such as solid shade, contrast etc of the constituting components of a blend.
5. To develop semi-cont. dyeing protocols on Pad mangle.
6. To develop different shades and to match these with standards.

Text Book:

Blends Dyeing Edited by John Shore (1998 Edition). Chapters 1-15. The Society of Dyers and Colorists (SDC), UK.

B. TECH. (TEXTILE CHEMISTRY) SEMESTER-VI
(Under Credit Based Continuous Evaluation Grading System)

TCP-305

PRINTING LAB – II

Credits: 0-0-2

1. Printing of cotton with Direct, Reactive, Vat, sulphur dyes & pigments.
2. Printing of wool with acid & metal complex dyes.
3. Printing of polyester with disperse dyes & pigments.
4. Printing of various blends e.g. polyester/cotton, polyester/wool and other available blends.
5. Printing of textile fabrics with different styles of printing i.e. Direct, discharge & resist.

Text Books:

- i) Textile Printing Edited by Leslie W.C.Miles (1994 Edition)
- ii) An Introduction to Textile Printing by W. Clarke, Newnes – Butterworths

Reference:

The Thames & Hudson Manual of Textile Printing by Joyce Storey. (1974 Edition)

TCP-306**FINISHING LAB****Credits: 0-0-2**

- 1 Crease-resistance finishing of cotton and viscose fabrics
- 2 Crease-resistance finishing of polyester/cotton and polyester/viscose fabrics
- 3 Determination of free formaldehyde in resin finished fabrics
- 4 Simultaneous dyeing and finishing
- 5 Softening and stiffening finishes
- 6 Carbonizing of wool and polyester/cotton fabrics
- 7 Anti-shrink treatments for wool
- 8 Determination of relaxational and washing shrinkage of woolen fabrics

Text Books:

1. Chemical Finishing of Textiles, by W.D. Schindler and P.J. Hauser, Woodhead Publishing Ltd, Aug 2004.
2. Textile Finishing, (Ed.) Derek Heywood, Society of Dyers and Colorists, 2003.
3. Handbook of Fiber Science and Technology: Volume-II, Chemical Processing of Fibres and Fabrics Functional Finishes Part-A and Part-B, Edited by Menachem Lewin and Stephen B. Sello.

TCE-301

INDUSTRIAL TRAINING

Credit: 0-0-6

Interdisciplinary Course – V

Interdisciplinary Course – VI

TCD-301

RESEARCH PROJECT

Credits: 0-0-2

Evaluation of literature survey

TCL-401

BUSINESS AND FINANCIAL MANAGEMENT

Credit: 3-1-0

UNIT – I

PART-I: Business Management

- 1. Definition and Scope of Management:** Fundamental principles, concept and philosophy of management, its use in major and small scale industries, types of organisation, elements of management. Characteristics and classification of wants. Law of demand, elasticity of demand and supply, market competition, monopoly and monopolistic competition, price determination under competition and monopoly. (6)
- 2. Plant Layout:** Location of factory, layout of plant, building equipment, factors important in decision making about the location of an industry. (4)
- 3. Management Policy:** Concept of scientific management in industry. General understanding of functions of management like decision making, planning, organising, directing and control. Practice of management control and delegation of authority, division into various departments, office management, joint stock companies, cooperative societies, board of directors, managing director, division into various sections. (10)
- 4. Production Management and Control:** Main considerations, factors influencing production control, Product design & development. (5)
- 5. Personnel Administration:** Personnel department, its organisation and function. Management of human resources, selection and training of employees, their welfare and safety, labour incentives/wages and remuneration. Absenteeism and its control. Factory Acts effecting industrial undertaking and workers in the factory. (5)
- 6. TQM and ISO Quality Management systems** (4)

UNIT – II

7. Role of Sugar/Textile Industry in Promoting Economic Growth Through Social Good.

- a) Microeconomics:- Monoplistic and oligoplistic market, optimisation of production
- b) Microeconomics:- Concept of excise Modvat, VAT, CT-3, Stock Exchange
- c) Textile/sugar economy of India and world. Its impact due to GATT agreement.

(10)

PART – II: FINANCIAL MANAGEMENT:

- 1. Objectives and Functions of Financial Management:** General understanding of marketing management, concept of market and marketing management, pricing policy, marketing media. Factors involved in project estimation, methods employed for the estimation of capital investment. Capital formation, Capital Structure: different sources of finance, types of capital and its cost determination. Capital budgeting decisions, method of appraising investment decision. Depreciation. Methods of determining depreciation, taxes. Optimum batch sizes, production scheduling.

(7)

UNIT – III

2. Capital Budgeting Decisions: method of appraising investment decisions. (3)

3. Costing and Cost Control: Elements of cost, cost factors, budgetry control, forms of budget and their integration, variation f cost with capacity, Break Even point. (3)

4. Invenry Management: Purchase, organisation and control. General understanding of the concept of material management. (3)

Texts:

- (i) Cost Accounting by Jain & Narang. Kalyani Publishers.
- (ii) Financial Management by Khan & Jain, Tata McGraw Hills.
- (iii) Principal & Practice of Management by T.N. Chabra. Dhanpat Rai & Sons, Delhi.
- (iv) Fundamentals of Book keeping & Accountancy by Sharma, Chug & Katyal. S. Dinesh & Comp., Jalandhar.
- (v) Production / Operation Management by B.S. Goyal. Pragti Precaution, Merrut.

TCL-402

WASTE MANAGEMENT IN TEXTILE INDUSTRY**Credit: 3-1-0****UNIT – I**

- 1. Introduction:** Basic understanding of terms such as pollution, industrial pollution, waste, point and non point sources, impact of textile industry on environment (Air, water & soil), toxicity of dyes & processing chemicals, Industrial hygiene & safety. (5)
- 2. Water Quality:** Water sources, water quality parameters such as colour, turbidity, pH, dissolved solids, suspended solids, alkalinity, hardness, chlorides, sulphates, silica, iron etc. and their harmful effects, water consumption, water quality requirement for textile processing and for boilers, Water purification by soda-alum process, Lime-soda process and base exchange process. (5)
- 3. Pollution Aspects in Pre-treatment Processes of Textiles:** Wastewater generation and its characterization from different processes, effects of textile effluents on environment such as effect of colour, biochemical oxygen demand, chemical oxygen demand, phenols, chromium, residual chlorine, oil and grease etc., Pollution loads in pre-treatment processing of cotton, wool and synthetic fibres, Desizing effluents, scouring effluents, bleaching effluents, auxiliary effluents, dyeing effluents. (10)

UNIT – II

- 4. Wastewater Treatment Techniques:** Physical/physico-chemical- Screening, primary sedimentation, adsorption, ion-exchange, coagulation/flocculation, membrane filtration such as reverse osmosis, radiations; Chemical- Neutralisation, Oxidation processes (Chlorination, Hydrogen peroxide), Advanced oxidation processes like Fenton's reagent, ozonation; Electrochemical treatment; Biological treatment- Aerobic (activated sludge, trickling filter, rotating biological contactor), Anaerobic and Sequential aerobic and anaerobic processes, Flow sheet for textile waste effluent. (15)
- 5. Waste Management:** Waste reduction, reducing pollution in textile dyeing, recycling and reuse of dyestuffs and chemicals, waste minimization by using eco-friendly technologies for textile processing such as ecofibres, environmental friendly chemical processing, minimization of chemical usage. (10)

UNIT – III

- 6. Environmental Regulation and Environmental Management Systems:** Regulatory measures for environmental management- Environmental (protection) Act, 1986, The environmental (protection) rules, 1986, International standards-ISO-14000, Discharge standards for textile industrial effluents, Environmental management systems (EMS) and Asset Management (AM), REACH (Registration, Evaluation, Authorisation and Restriction of Chemicals). (5)
- 7. Recent Developments in Wastewater Management in Textile Industry:** Eco-friendly technologies for textile chemical processing, Reducing pollution load: sustainable water consumption and energy, recent developments in colour removal technologies for synthetic textile wastewater as well as real textile industrial effluent, Developments in biological treatment of textile effluents, Recent environmental legislations relating to textile industry. (10)

Texts:

1. Environmental Aspects of Textile Dyeing, Edited by R.M. Christie, Woodhead Publishing Limited, Cambridge, England, 2007.
2. Training Report on The Programme on Treatment and Reuse of Textile Industry Effluents, December 10th to 12th, 2008, Organized by Department of Textile Technology, IIT, Delhi.
3. Chemical Technology in The Pre-treatment Processes of Textiles, Edited by S.R. Karmakar, Elsevier Publications, The Netherlands.
4. Wastewater Management for Textile Industry–An Overview, A.S. Bal, Indian J. Environ. Hlth. 41(4), 264-290, 1990.
5. ISI Standards for Effluent Treatment in Textile Industries.

TCL- 403 GARMENT MANUFACTURING & PROCESSING TECHNOLOGY

Credit: 3-1-0

UNIT – I

1. **Garment Manufacturing Technology:** Brief outlook of garment manufacturing industry and its classification. Concept of garment design and production. Low stress mechanical properties of fabrics and their effect on garment production sequences. Garment sizing. Pattern making and grading, Principles of marker making (spreading and cutting, cutting methods). Sewing faults, their causes and remedies. Different types of sewing machines and their principles, Choice of sewing needles and threads etc. Fusing and pressing machines. Quality control systems in garment manufacturing. (15)

UNIT – II

2. **Garment Processing Machinery:** Introduction to the machinery used for garment processing, its differences / similarities with the machinery used for fabric processing. Principles, sketches and working of wash-wheel, hydro extractor and dryers used in Garment processing. (8)
3. **Garment Dyeing Machines:** Side-paddle machines, overhead paddle machines, Rotating drum machines, Tumblers, High temperature garment dyeing machines, dye boarding machines. (5)
4. **Machine-Washable Knitwear Production Routes:** Introduction, Garment treatments: equipment, scouring and milling procedures for woolen spun knitwear , scouring and anti-cockle procedures for worsted spun knitwear, Garment shrink –resist treatments for knitwear, polymer-only treatments, yarn treatment, continuous treatments, environmental considerations etc. (10)

UNIT – III

5. **Garment Printing:** Introduction, selection of dye classes, printing methods, block printing, roller printing, rotary printing, manual screen printing, flat belt printing, transfer printing, pigment printing, trends in garment printing, foam or raise binder, leathery or plastic printing, khadi printing, metallic print Gold, silver, copper print, Fluorescent & Phosphorescent printing, pearl printing, gliter printing, thermo colour printing and label printing. (8)

B. TECH. (TEXTILE CHEMISTRY) SEMESTER-VII
(Under Credit Based Continuous Evaluation Grading System)

6. **Garment Finishing:** Removal of stains, DP Garments, Permanent silting of woolen garments, wash-n-wear garments, novelty effects, short gun, stone wash, bio wash, sand busting treatments etc. (12)
7. **Defects and Remedies:** Occurrence of defects in the processing of garments and its remedial measures shall be discussed. (2)

Books:

1. Engineering in Textile Coloration Edited by C. Duckworth (1983 Edition), Chapter-1 Pages 1-68. The Dyers Company Publication Trust, Distributed by The Society of Dyers and Colorists (SDC), UK.
2. Chemistry of the Textiles Industry, C.M. Carr.
3. Printing by W.C. Miles.
4. Introduction to Garment Manufacture by G. Cooklin (Blackwell Sciences).

Interdisciplinary Course – VII
Interdisciplinary Course – VIII

TCS-401

SEMINAR

Credits: 4

TCD- 401

RESEARCH PROJECT

Credits: 0-0-4

TCD-402

RESEARCH PROJECT

Credits: 0-0-4

TCE-401

INDUSTRIAL TRAINING
(Jan-April)

Credits: 16