

ANNA UNIVERSITY, CHENNAI
NON-AUTONOMOUS COLLEGES AFFILIATED TO ANNA UNIVERSITY
REGULATIONS 2021
B. TECH. TEXTILE CHEMISTRY
CHOICE BASED CREDIT SYSTEM
I AND II SEMESTERS CURRICULA AND SYLLABUS
SEMESTER I

S. No.	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	IP3151	Induction Programme	-	-	-	-	-	0
THEORY								
2.	HS3151	Professional English - I	HSMC	3	1	0	4	4
3.	MA3151	Matrices and Calculus	BSC	3	1	0	4	4
4.	PH3151	Engineering Physics	BSC	3	0	0	3	3
5.	CY3151	Engineering Chemistry	BSC	3	0	0	3	3
6.	GE3151	Problem Solving and Python Programming	ESC	3	0	0	3	3
PRACTICALS								
7.	GE3171	Problem Solving and Python Programming Laboratory	ESC	0	0	4	4	2
8.	BS3171	Physics and Chemistry Laboratory	BSC	0	0	4	4	2
TOTAL				15	2	8	25	21

SEMESTER II

SI. NO.	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	HS3251	Professional English - II	HSMC	3	1	0	4	4
2.	MA3251	Statistics and Numerical Methods	BSC	3	1	0	4	4
3.	PH3257	Physics for Textile Technologists	BSC	3	0	0	3	3
4.	BE3252	Basic Electrical, Electronics and Instrumentation Engineering	ESC	3	0	0	3	3
5.	GE3251	Engineering Graphics	ESC	2	0	4	6	4
6.	CY3252	Chemistry for Textile Technologists	BSC	3	0	0	3	3
7.		NCC Credit Course Level 1*	-	2	0	0	2	2
PRACTICALS								
8.	GE3271	Engineering Practices Laboratory	ESC	0	0	4	4	2
9.	BE3272	Basic Electrical, Electronics and Instrumentation Engineering Laboratory	ESC	0	0	4	4	2
TOTAL				17	2	12	31	25

*NCC Credit Course level 1 is offered for NCC students only. The grades earned by the students will be recorded in the Mark Sheet, however the same shall not be considered for the computation of CGPA.

IP3151

INDUCTION PROGRAMME

This is a mandatory 2 week programme to be conducted as soon as the students enter the institution. Normal classes start only after the induction program is over.

The induction programme has been introduced by AICTE with the following objective:

“Engineering colleges were established to train graduates well in the branch/department of admission, have a holistic outlook, and have a desire to work for national needs and beyond. The graduating student must have knowledge and skills in the area of his/her study. However, he/she must also have broad understanding of society and relationships. Character needs to be nurtured as an essential quality by which he/she would understand and fulfill his/her responsibility as an engineer, a citizen and a human being. Besides the above, several meta-skills and underlying values are needed.”

“One will have to work closely with the newly joined students in making them feel comfortable, allow them to explore their academic interests and activities, reduce competition and make them work for excellence, promote bonding within them, build relations between teachers and students, give a broader view of life, and build character. “

Hence, the purpose of this programme is to make the students feel comfortable in their new environment, open them up, set a healthy daily routine, create bonding in the batch as well as between faculty and students, develop awareness, sensitivity and understanding of the self, people around them, society at large, and nature.

The following are the activities under the induction program in which the student would be fully engaged throughout the day for the entire duration of the program.

(i) Physical Activity

This would involve a daily routine of physical activity with games and sports, yoga, gardening, etc.

(ii) Creative Arts

Every student would choose one skill related to the arts whether visual arts or performing arts. Examples are painting, sculpture, pottery, music, dance etc. The student would pursue it everyday for the duration of the program. These would allow for creative expression. It would develop a sense of aesthetics and also enhance creativity which would, hopefully, grow into engineering design later.

(iii) Universal Human Values

This is the anchoring activity of the Induction Programme. It gets the student to explore oneself and allows one to experience the joy of learning, stand up to peer pressure, take decisions with courage, be aware of relationships with colleagues and supporting stay in the hostel and department, be sensitive to others, etc. A module in Universal Human Values provides the base. Methodology of teaching this content is extremely important. It must not be through do's and dont's, but get students to explore and think by engaging them in a dialogue. It is best taught through group discussions and real life activities rather than lecturing.

Discussions would be conducted in small groups of about 20 students with a faculty mentor each. It would be effective that the faculty mentor assigned is also the faculty advisor for the student for the full duration of the UG programme.

(iv) Literary Activity

Literary activity would encompass reading, writing and possibly, debating, enacting a play etc.

(v) Proficiency Modules

This would address some lacunas that students might have, for example, English, computer familiarity etc.

(vi) Lectures by Eminent People

Motivational lectures by eminent people from all walks of life should be arranged to give the students exposure to people who are socially active or in public life.

(vii) Visits to Local Area

A couple of visits to the landmarks of the city, or a hospital or orphanage could be organized. This would familiarize them with the area as well as expose them to the under privileged.

(viii) Familiarization to Dept./Branch & Innovations

They should be told about what getting into a branch or department means what role it plays in society, through its technology. They should also be shown the laboratories, workshops & other facilities.

(ix) Department Specific Activities

About a week can be spent in introducing activities (games, quizzes, social interactions, small experiments, design thinking etc.) that are relevant to the particular branch of Engineering / Technology / Architecture that can serve as a motivation and kindle interest in building things (become a maker) in that particular field. This can be conducted in the form of a workshop. For example, CSE and IT students may be introduced to activities that kindle computational thinking, and get them to build simple games. ECE students may be introduced to building simple circuits as an extension of their knowledge in Science, and so on. Students may be asked to build stuff using their knowledge of science.

Induction Programme is totally an activity based programme and therefore there shall be no tests / assessments during this programme.

REFERENCES:

Guide to Induction program from AICTE

HS3151

PROFESSIONAL ENGLISH - I

L T P C

3 1 0 4

COURSE OBJECTIVES:

- To improve the communicative competence of learners
- To help learners use language effectively in academic /work contexts
- To build on students' English language skills by engaging them in listening, speaking and grammar learning activities that are relevant to authentic contexts.
- To develop learners' ability to read and write complex texts, summaries, articles, blogs, definitions, essays and user manuals.
- To use language efficiently in expressing their opinions via various media.

INTRODUCTION TO EFFECTIVE COMMUNICATION**1**

- What is effective communication? (There are many interesting activities for this.)
- Why is communication critical for excellence during study, research and work?
- What are the seven C's of effective communication?
- What are key language skills?
- What is effective listening? What does it involve?
- What is effective speaking?
- What does it mean to be an excellent reader? What should you be able to do?
- What is effective writing?
- How does one develop language and communication skills?
- What does the course focus on? How are communication and language skills going to be enhanced during this course? What do you as a learner need to do to enhance your English language and communication skills to get the best out of this course?

UNIT I INTRODUCTION TO FUNDAMENTALS OF COMMUNICATION**11**

Listening –for general information-specific details- conversation: Introduction to classmates - Audio / video (formal & informal); Telephone conversation; Listening to voicemail & messages; Listening and filling a form. **Speaking** - Self Introduction; Introducing a friend; Conversation - politeness strategies; Telephone conversation; Leave a voicemail; Leave a message with another person; asking for information to fill details in a form. **Reading** - Reading brochures (technical context), telephone messages / social media messages relevant to technical contexts and emails. **Writing** - Writing emails / letters introducing oneself. **Grammar** - Present Tense (simple and progressive); Question types: Wh/ Yes or No/ and Tags . **Vocabulary** - Synonyms; One word substitution; Abbreviations & Acronyms (as used in technical contexts).

UNIT II NARRATION AND SUMMATION**12**

Listening - Listening to podcast, anecdotes / stories / event narration; documentaries and interviews with celebrities. **Speaking** - Narrating personal experiences / events; Interviewing a celebrity; Reporting / and summarizing of documentaries / podcasts/ interviews. **Reading** - Reading biographies, travelogues, newspaper reports, Excerpts from literature, and travel & technical blogs. **Writing** - Guided writing-- Paragraph writing Short Report on an event (field trip etc.) **Grammar** –Past tense (simple); Subject-Verb Agreement; and Prepositions. **Vocabulary** - Word forms (prefixes& suffixes); Synonyms and Antonyms. Phrasal verbs.

UNIT III DESCRIPTION OF A PROCESS / PRODUCT**12**

Listening - Listen to a product and process descriptions; a classroom lecture; and advertisements about a products. **Speaking** – Picture description; giving instruction to use the product; Presenting a product; and summarizing a lecture. **Reading** – Reading advertisements, gadget reviews; user manuals. **Writing** - Writing definitions; instructions; and Product /Process description. **Grammar** - Imperatives; Adjectives; Degrees of comparison; Present & Past Perfect Tenses. **Vocabulary** - Compound Nouns, Homonyms; and Homophones, discourse markers (connectives & sequence words

UNIT IV CLASSIFICATION AND RECOMMENDATIONS**12**

Listening – Listening to TED Talks; Scientific lectures; and educational videos. **Speaking** – Small Talk; Mini presentations and making recommendations. **Reading** – Newspaper articles; Journal reports –and Non Verbal Communication (tables, pie charts etc) **Writing** – Note-making / Note-taking (*Study skills to be taught, not tested; Writing recommendations; Transferring information from non verbal (chart , graph etc, to verbal mode). **Grammar** – Articles; Pronouns - Possessive & Relative pronouns .**Vocabulary** - Collocations; Fixed / Semi fixed expressions.

UNIT V EXPRESSION**12**

Listening – Listening to debates/ discussions; different viewpoints on an issue; and panel discussions. **Speaking** –group discussions, Debates, and Expressing opinions through Simulations & Role play. **Reading** – Reading editorials; and Opinion Blogs; **Writing** – Essay Writing (Descriptive or narrative). **Grammar** – Future Tenses, Punctuation; Negation (Statements & Questions); and Simple, Compound & Complex Sentences. **Vocabulary** - Cause & Effect Expressions – Content vs Function words.

TOTAL: 60 PERIODS**COURSE OUTCOMES:**

At the end of the course, learners will be able

- CO1 : To listen and comprehend complex academic texts
- CO2 : To read and infer the denotative and connotative meanings of technical texts
- CO3 : To write definitions, descriptions, narrations and essays on various topics
- CO4 : To speak fluently and accurately in formal and informal communicative contexts
- CO5 : To express their opinions effectively in both oral and written medium of communication

TEXT BOOKS:

1. English for Engineers & Technologists Orient Blackswan Private Ltd. Department of English, Anna University, (2020 edition)
2. English for Science & Technology Cambridge University Press, 2021.
 Authored by Dr. Veena Selvam, Dr. Sujatha Priyadarshini, Dr. Deepa Mary Francis, Dr. KN. Shoba, and Dr. Lourdes Joevani, Department of English, Anna University.

REFERENCES:

1. Technical Communication – Principles And Practices By Meenakshi Raman & Sangeeta Sharma, Oxford Univ. Press, 2016, New Delhi.
2. A Course Book on Technical English By Lakshmi Narayanan, Scitech Publications (India) Pvt. Ltd.
3. English For Technical Communication (With CD) By Aysha Viswamohan, Mcgraw Hill Education, ISBN : 0070264244.
4. Effective Communication Skill, Kulbhusan Kumar, R S Salaria, Khanna Publishing House. Learning to Communicate – Dr. V. Chellammal, Allied Publishing House, New Delhi, 2003.

MA3151**MATRICES AND CALCULUS****L T P C**
3 1 0 4**COURSE OBJECTIVES:**

- To develop the use of matrix algebra techniques that is needed by engineers for practical applications.
- To familiarize the students with differential calculus.
- To familiarize the student with functions of several variables. This is needed in many branches of engineering.
- To make the students understand various techniques of integration.
- To acquaint the student with mathematical tools needed in evaluating multiple integrals and their applications.

UNIT I MATRICES**9+3**

Eigenvalues and Eigenvectors of a real matrix – Characteristic equation – Properties of Eigenvalues and Eigenvectors – Cayley - Hamilton theorem – Diagonalization of matrices by orthogonal transformation – Reduction of a quadratic form to canonical form by orthogonal transformation – Nature of quadratic forms – Applications : Stretching of an elastic membrane.

UNIT II DIFFERENTIAL CALCULUS**9+3**

Representation of functions - Limit of a function - Continuity - Derivatives - Differentiation rules (sum, product, quotient, chain rules) - Implicit differentiation - Logarithmic differentiation - Applications : Maxima and Minima of functions of one variable.

UNIT III FUNCTIONS OF SEVERAL VARIABLES**9+3**

Partial differentiation – Homogeneous functions and Euler’s theorem – Total derivative – Change of variables – Jacobians – Partial differentiation of implicit functions – Taylor’s series for functions of two variables – Applications : Maxima and minima of functions of two variables and Lagrange’s method of undetermined multipliers.

UNIT IV INTEGRAL CALCULUS**9+3**

Definite and Indefinite integrals - Substitution rule - Techniques of Integration : Integration by parts, Trigonometric integrals, Trigonometric substitutions, Integration of rational functions by partial fraction, Integration of irrational functions - Improper integrals - Applications : Hydrostatic force and pressure, moments and centres of mass.

UNIT V MULTIPLE INTEGRALS**9+3**

Double integrals – Change of order of integration – Double integrals in polar coordinates – Area enclosed by plane curves – Triple integrals – Volume of solids – Change of variables in double and triple integrals – Applications : Moments and centres of mass, moment of inertia

TOTAL: 60 PERIODS**COURSE OUTCOMES:**

At the end of the course the students will be able to

- CO1 : Use the matrix algebra methods for solving practical problems.
- CO2 : Apply differential calculus tools in solving various application problems.
- CO3 : Able to use differential calculus ideas on several variable functions.
- CO4 : Apply different methods of integration in solving practical problems.
- CO5 : Apply multiple integral ideas in solving areas, volumes and other practical problems.

TEXT BOOKS :

1. Kreyszig, E., "Advanced Engineering Mathematics", John Wiley and Sons, 10th Edition, New Delhi, 2016.
2. Grewal, B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 44th Edition, 2018.
3. James Stewart, "Calculus : Early Transcendentals", Cengage Learning, 8th Edition, New Delhi, 2015. [For Units II & IV - Sections 1.1, 2.2, 2.3, 2.5, 2.7 (Tangents problems only), 2.8, 3.1 to 3.6, 3.11, 4.1, 4.3, 5.1 (Area problems only), 5.2, 5.3, 5.4 (excluding net change theorem), 5.5, 7.1 - 7.4 and 7.8].

REFERENCES :

1. Anton. H, Bivens. I and Davis. S, "Calculus", Wiley, 10th Edition, 2016
2. Bali. N., Goyal. M. and Watkins. C., "Advanced Engineering Mathematics", Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.), New Delhi, 7th Edition, 2009.
3. Jain . R.K. and Iyengar. S.R.K., "Advanced Engineering Mathematics", Narosa Publications, New Delhi, 5th Edition, 2016.
4. Narayanan. S. and Manicavachom Pillai. T. K., "Calculus" Volume I and II, S. Viswanathan Publishers Pvt. Ltd., Chennai, 2009.
5. Ramana. B.V., "Higher Engineering Mathematics", McGraw Hill Education Pvt. Ltd, New Delhi, 2016.
6. Srimantha Pal and Bhunia. S.C, "Engineering Mathematics" Oxford University Press, 2015.
7. Thomas. G. B., Hass. J, and Weir. M.D, "Thomas Calculus", 14th Edition, Pearson India, 2018.

COURSE OBJECTIVES

- To make the students effectively to achieve an understanding of mechanics.
- To enable the students to gain knowledge of electromagnetic waves and its applications.
- To introduce the basics of oscillations, optics and lasers.
- Equipping the students to be successfully understand the importance of quantum physics.
- To motivate the students towards the applications of quantum mechanics.

UNIT I MECHANICS**9**

Multi-particle dynamics: Center of mass (CM) – CM of continuous bodies – motion of the CM – kinetic energy of system of particles. Rotation of rigid bodies: Rotational kinematics – rotational kinetic energy and moment of inertia - theorems of M .I –moment of inertia of continuous bodies – M.I of a diatomic molecule - torque – rotational dynamics of rigid bodies – conservation of angular momentum – rotational energy state of a rigid diatomic molecule - gyroscope - torsional pendulum – double pendulum –Introduction to nonlinear oscillations.

UNIT II ELECTROMAGNETIC WAVES**9**

The Maxwell's equations - wave equation; Plane electromagnetic waves in vacuum, Conditions on the wave field - properties of electromagnetic waves: speed, amplitude, phase, orientation and waves in matter - polarization - Producing electromagnetic waves - Energy and momentum in EM waves: Intensity, waves from localized sources, momentum and radiation pressure - Cell-phone reception. Reflection and transmission of electromagnetic waves from a non-conducting medium-vacuum interface for normal incidence.

UNIT III OSCILLATIONS, OPTICS AND LASERS**9**

Simple harmonic motion - resonance –analogy between electrical and mechanical oscillating systems - waves on a string - standing waves - traveling waves - Energy transfer of a wave - sound waves - Doppler effect. Reflection and refraction of light waves - total internal reflection - interference –Michelson interferometer –Theory of air wedge and experiment. Theory of laser - characteristics - Spontaneous and stimulated emission - Einstein's coefficients - population inversion - Nd-YAG laser, CO₂ laser, semiconductor laser –Basic applications of lasers in industry.

UNIT IV BASIC QUANTUM MECHANICS**9**

Photons and light waves - Electrons and matter waves –Compton effect - The Schrodinger equation (Time dependent and time independent forms) - meaning of wave function - Normalization –Free particle - particle in a infinite potential well: 1D,2D and 3D Boxes- Normalization, probabilities and the correspondence principle.

UNIT V APPLIED QUANTUM MECHANICS**9**

The harmonic oscillator(qualitative)- Barrier penetration and quantum tunneling(qualitative)- Tunneling microscope - Resonant diode - Finite potential wells (qualitative)- Bloch's theorem for particles in a periodic potential –Basics of Kronig-Penney model and origin of energy bands.

TOTAL : 45 PERIODS**COURSE OUTCOMES**

After completion of this course, the students should be able to

- CO1 : Understand the importance of mechanics.
- CO2 : Express their knowledge in electromagnetic waves.
- CO3 : Demonstrate a strong foundational knowledge in oscillations, optics and lasers.
- CO4 : Understand the importance of quantum physics.
- CO5 : Comprehend and apply quantum mechanical principles towards the formation of energy bands.

TEXT BOOKS:

1. D.Kleppner and R.Kolenkow. An Introduction to Mechanics. McGraw Hill Education (Indian Edition), 2017.
2. E.M.Purcell and D.J.Morin, Electricity and Magnetism, Cambridge Univ.Press, 2013.
3. Arthur Beiser, Shobhit Mahajan, S. Rai Choudhury, Concepts of Modern Physics, McGraw-Hill (Indian Edition), 2017.

REFERENCES:

1. R.Wolfson. Essential University Physics. Volume 1 & 2. Pearson Education (Indian Edition), 2009.
2. Paul A. Tipler, Physic – Volume 1 & 2, CBS, (Indian Edition), 2004.
3. K.Thyagarajan and A.Ghatak. Lasers: Fundamentals and Applications, Laxmi Publications, (Indian Edition), 2019.
4. D.Halliday, R.Resnick and J.Walker. Principles of Physics, Wiley (Indian Edition), 2015.
5. N.Garcia, A.Damask and S.Schwarz. Physics for Computer Science Students. Springer-Verlag,

CY3151**ENGINEERING CHEMISTRY****L T P C
3 0 0 3****COURSE OBJECTIVES:**

- To inculcate sound understanding of water quality parameters and water treatment techniques.
- To impart knowledge on the basic principles and preparatory methods of nanomaterials.
- To introduce the basic concepts and applications of phase rule and composites.
- To facilitate the understanding of different types of fuels, their preparation, properties and combustion characteristics.
- To familiarize the students with the operating principles, working processes and applications of energy conversion and storage devices.

UNIT I WATER AND ITS TREATMENT**9**

Water: Sources and impurities, Water quality parameters: Definition and significance of-color, odour, turbidity, pH, hardness, alkalinity, TDS, COD and BOD, flouride and arsenic. Municipal water treatment: primary treatment and disinfection (UV, Ozonation, break-point chlorination). Desalination of brackish water: Reverse Osmosis. Boiler troubles: Scale and sludge, Boiler corrosion, Caustic embrittlement, Priming &foaming. Treatment of boiler feed water: Internal treatment (phosphate, colloidal, sodium aluminate and calgon conditioning) and External treatment – Ion exchange demineralization and zeolite process.

UNIT II NANOCHEMISTRY**9**

Basics: Distinction between molecules, nanomaterials and bulk materials; Size-dependent properties (optical, electrical, mechanical and magnetic); Types of nanomaterials: Definition, properties and uses of – nanoparticle, nanocluster, nanorod, nanowire and nanotube. Preparation of nanomaterials: sol-gel, solvothermal, laser ablation, chemical vapour deposition, electrochemical deposition and electro spinning. Applications of nanomaterials in medicine, agriculture, energy, electronics and catalysis.

UNIT III PHASE RULE AND COMPOSITES**9**

Phase rule: Introduction, definition of terms with examples. One component system - water system; Reduced phase rule; Construction of a simple eutectic phase diagram - Thermal analysis; Two component system: lead-silver system - Pattinson process.

Composites: Introduction: Definition & Need for composites; Constitution: Matrix materials (Polymer matrix, metal matrix and ceramic matrix) and Reinforcement (fiber, particulates, flakes and whiskers). Properties and applications of: Metal matrix composites (MMC), Ceramic matrix composites and Polymer matrix composites. Hybrid composites - definition and examples.

UNIT IV FUELS AND COMBUSTION**9**

Fuels: Introduction: Classification of fuels; Coal and coke: Analysis of coal (proximate and ultimate), Carbonization, Manufacture of metallurgical coke (Otto Hoffmann method). Petroleum and Diesel: Manufacture of synthetic petrol (Bergius process), Knocking - octane number, diesel oil - cetane number; Power alcohol and biodiesel.

Combustion of fuels: Introduction: Calorific value - higher and lower calorific values, Theoretical calculation of calorific value; Ignition temperature: spontaneous ignition temperature, Explosive range; Flue gas analysis - ORSAT Method. CO₂ emission and carbon foot print.

UNIT V ENERGY SOURCES AND STORAGE DEVICES**9**

Stability of nucleus: mass defect (problems), binding energy; Nuclear energy: light water nuclear power plant, breeder reactor. Solar energy conversion: Principle, working and applications of solar cells; Recent developments in solar cell materials. Wind energy; Geothermal energy; Batteries: Types of batteries, Primary battery - dry cell, Secondary battery - lead acid battery and lithium-ion-battery; Electric vehicles; working principles; Fuel cells: H₂-O₂ fuel cell, microbial fuel cell; Supercapacitors: Storage principle, types and examples.

TOTAL: 45 PERIODS**COURSE OUTCOMES**

At the end of the course, the students will be able:

- CO1 :To infer the quality of water from quality parameter data and propose suitable treatment methodologies to treat water.
- CO2 :To identify and apply basic concepts of nanoscience and nanotechnology in designing the synthesis of nanomaterials for engineering and technology applications.
- CO3 :To apply the knowledge of phase rule and composites for material selection requirements.
- CO4 :To recommend suitable fuels for engineering processes and applications.
- CO5 :To recognize different forms of energy resources and apply them for suitable application in energy sectors.

TEXT BOOKS:

1. P. C. Jain and Monica Jain, "Engineering Chemistry", 17th Edition, Dhanpat Rai Publishing Company (P) Ltd, New Delhi, 2018.
2. Sivasankar B., "Engineering Chemistry", Tata McGraw-Hill Publishing Company Ltd, New Delhi, 2008.
3. S.S. Dara, "A Text book of Engineering Chemistry", S. Chand Publishing, 12th Edition, 2018.

REFERENCES:

1. B. S. Murty, P. Shankar, Baldev Raj, B. B. Rath and James Murday, "Text book of nanoscience and nanotechnology", Universities Press-IIM Series in Metallurgy and Materials Science, 2018.
2. O.G. Palanna, "Engineering Chemistry" McGraw Hill Education (India) Private Limited, 2nd Edition, 2017.
3. Friedrich Emich, "Engineering Chemistry", Scientific International PVT, LTD, New Delhi, 2014.

4. Shikha Agarwal, "Engineering Chemistry-Fundamentals and Applications", Cambridge University Press, Delhi, Second Edition, 2019.
5. O.V. Roussak and H.D. Gesser, Applied Chemistry-A Text Book for Engineers and Technologists, Springer Science Business Media, New York, 2nd Edition, 2013.

GE3151**PROBLEM SOLVING AND PYTHON PROGRAMMING****L T P C
3 0 0 3****OBJECTIVES:**

- To understand the basics of algorithmic problem solving.
- To learn to solve problems using Python conditionals and loops.
- To define Python functions and use function calls to solve problems.
- To use Python data structures - lists, tuples, dictionaries to represent complex data.
- To do input/output with files in Python.

UNIT I COMPUTATIONAL THINKING AND PROBLEM SOLVING 9

Fundamentals of Computing – Identification of Computational Problems -Algorithms, building blocks of algorithms (statements, state, control flow, functions), notation (pseudo code, flow chart, programming language), algorithmic problem solving, simple strategies for developing algorithms (iteration, recursion). Illustrative problems: find minimum in a list, insert a card in a list of sorted cards, guess an integer number in a range, Towers of Hanoi.

UNIT II DATA TYPES, EXPRESSIONS, STATEMENTS 9

Python interpreter and interactive mode, debugging; values and types: int, float, boolean, string, and list; variables, expressions, statements, tuple assignment, precedence of operators, comments; Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two points.

UNIT III CONTROL FLOW, FUNCTIONS, STRINGS 9

Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: state, while, for, break, continue, pass; Fruitful functions: return values, parameters, local and global scope, function composition, recursion; Strings: string slices, immutability, string functions and methods, string module; Lists as arrays. Illustrative programs: square root, gcd, exponentiation, sum an array of numbers, linear search, binary search.

UNIT IV LISTS, TUPLES, DICTIONARIES 9

Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing - list comprehension; Illustrative programs: simple sorting, histogram, Students marks statement, Retail bill preparation.

UNIT V FILES, MODULES, PACKAGES 9

Files and exception: text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, modules, packages; Illustrative programs: word count, copy file, Voter's age validation, Marks range validation (0-100).

TOTAL : 45 PERIODS

OUTCOMES:

Upon completion of the course, students will be able to

- CO1: Develop algorithmic solutions to simple computational problems.
- CO2: Develop and execute simple Python programs.
- CO3: Write simple Python programs using conditionals and looping for solving problems.
- CO4: Decompose a Python program into functions.
- CO5: Represent compound data using Python lists, tuples, dictionaries etc.
- CO6: Read and write data from/to files in Python programs.

TEXT BOOKS:

1. Allen B. Downey, "Think Python : How to Think like a Computer Scientist", 2nd Edition, O'Reilly Publishers, 2016.
2. Karl Beecher, "Computational Thinking: A Beginner's Guide to Problem Solving and programming", 1st Edition, BCS Learning & Development Limited, 2017.

REFERENCES:

1. Paul Deitel and Harvey Deitel, "Python for Programmers", Pearson Education, 1st Edition, 2021.
2. G Venkatesh and Madhavan Mukund, "Computational Thinking: A Primer for Programmers and Data Scientists", 1st Edition, Notion Press, 2021.
3. John V Guttag, "Introduction to Computation and Programming Using Python: With Applications to Computational Modeling and Understanding Data", Third Edition, MIT Press , 2021
4. Eric Matthes, "Python Crash Course, A Hands - on Project Based Introduction to Programming", 2nd Edition, No Starch Press, 2019.
5. <https://www.python.org/>
6. Martin C. Brown, "Python: The Complete Reference", 4th Edition, Mc-Graw Hill, 2018.

GE3171 PROBLEM SOLVING AND PYTHON PROGRAMMING LABORATORY L T P C
0 0 4 2

OBJECTIVES:

- To understand the problem solving approaches.
- To learn the basic programming constructs in Python.
- To practice various computing strategies for Python-based solutions to real world problems.
- To use Python data structures - lists, tuples, dictionaries.
- To do input/output with files in Python.

EXPERIMENTS:

Note: The examples suggested in each experiment are only indicative. The lab instructor is expected to design other problems on similar lines. The Examination shall not be restricted to the sample experiments listed here.

1. Identification and solving of simple real life or scientific or technical problems, and developing flow charts for the same. (Electricity Billing, Retail shop billing, Sin series, weight of a motorbike, Weight of a steel bar, compute Electrical Current in Three Phase AC Circuit, etc.)
2. Python programming using simple statements and expressions (exchange the values of two variables, circulate the values of n variables, distance between two points).

3. Scientific problems using Conditionals and Iterative loops. (Number series, Number Patterns, pyramid pattern)
4. Implementing real-time/technical applications using Lists, Tuples. (Items present in a library/Components of a car/ Materials required for construction of a building –operations of list & tuples)
5. Implementing real-time/technical applications using Sets, Dictionaries. (Language, components of an automobile, Elements of a civil structure, etc.- operations of Sets & Dictionaries)
6. Implementing programs using Functions. (Factorial, largest number in a list, area of shape)
7. Implementing programs using Strings. (reverse, palindrome, character count, replacing characters)
8. Implementing programs using written modules and Python Standard Libraries (pandas, numpy. Matplotlib, scipy)
9. Implementing real-time/technical applications using File handling. (copy from one file to another, word count, longest word)
10. Implementing real-time/technical applications using Exception handling. (divide by zero error, voter's age validity, student mark range validation)
11. Exploring Pygame tool.
12. Developing a game activity using Pygame like bouncing ball, car race etc.

TOTAL: 60 PERIODS

OUTCOMES:

On completion of the course, students will be able to:

CO1: Develop algorithmic solutions to simple computational problems

CO2: Develop and execute simple Python programs.

CO3: Implement programs in Python using conditionals and loops for solving problems..

CO4: Deploy functions to decompose a Python program.

CO5: Process compound data using Python data structures.

CO6: Utilize Python packages in developing software applications.

TEXT BOOKS:

1. Allen B. Downey, "Think Python : How to Think like a Computer Scientist", 2nd Edition, O'Reilly Publishers, 2016.
2. Karl Beecher, "Computational Thinking: A Beginner's Guide to Problem Solving and Programming", 1st Edition, BCS Learning & Development Limited, 2017.

REFERENCES:

1. Paul Deitel and Harvey Deitel, "Python for Programmers", Pearson Education, 1st Edition, 2021.
2. G Venkatesh and Madhavan Mukund, "Computational Thinking: A Primer for Programmers and Data Scientists", 1st Edition, Notion Press, 2021.
3. John V Guttag, "Introduction to Computation and Programming Using Python: With Applications to Computational Modeling and Understanding Data", Third Edition, MIT Press , 2021
4. Eric Matthes, "Python Crash Course, A Hands - on Project Based Introduction to Programming", 2nd Edition, No Starch Press, 2019.
5. <https://www.python.org/>
6. Martin C. Brown, "Python: The Complete Reference", 4th Edition, Mc-Graw Hill, 2018.

PHYSICS LABORATORY : (Any Seven Experiments)**COURSE OBJECTIVES:**

- To learn the proper use of various kinds of physics laboratory equipment.
- To learn how data can be collected, presented and interpreted in a clear and concise manner.
- To learn problem solving skills related to physics principles and interpretation of experimental data.
- To determine error in experimental measurements and techniques used to minimize such error.
- To make the student as an active participant in each part of all lab exercises.

LIST OF EXPERIMENTS

1. Torsional pendulum - Determination of rigidity modulus of wire and moment of inertia of regular and irregular objects.
2. Simple harmonic oscillations of cantilever.
3. Non-uniform bending - Determination of Young's modulus
4. Uniform bending – Determination of Young's modulus
5. Laser- Determination of the wave length of the laser using grating
6. Air wedge - Determination of thickness of a thin sheet/wire
7. a) Optical fibre -Determination of Numerical Aperture and acceptance angle
b) Compact disc- Determination of width of the groove using laser.
8. Acoustic grating- Determination of velocity of ultrasonic waves in liquids.
9. Ultrasonic interferometer – determination of the velocity of sound and compressibility of liquids
10. Post office box -Determination of Band gap of a semiconductor.
11. Photoelectric effect
12. Michelson Interferometer.
13. Melde's string experiment
14. Experiment with lattice dynamics kit.

TOTAL: 30 PERIODS**COURSE OUTCOMES:**

Upon completion of the course, the students should be able to

- CO1 : Understand the functioning of various physics laboratory equipment.
 CO2 : Use graphical models to analyze laboratory data.
 CO3 : Use mathematical models as a medium for quantitative reasoning and describing physical reality.
 CO4 : Access, process and analyze scientific information.
 CO5 : Solve problems individually and collaboratively.

CHEMISTRY LABORATORY: (Any seven experiments)**OBJECTIVES:**

- To inculcate experimental skills to test basic understanding of water quality parameters, such as, acidity, alkalinity, hardness, DO, chloride and copper.
- To induce the students to familiarize with electroanalytical techniques such as, pH metry, potentiometry and conductometry in the determination of impurities in aqueous solutions.
- To demonstrate the analysis of metals and alloys.
- To demonstrate the synthesis of nanoparticles

CHEMISTRY LABORATORY: (Any seven experiments to be conducted)

1. Preparation of Na_2CO_3 as a primary standard and estimation of acidity of a water sample using the primary standard
2. Determination of types and amount of alkalinity in water sample.
 - Split the first experiment into two
3. Determination of total, temporary & permanent hardness of water by EDTA method.
4. Determination of DO content of water sample by Winkler's method.
5. Determination of chloride content of water sample by Argentometric method.
6. Estimation of copper content of the given solution by Iodometry.
7. Estimation of TDS of a water sample by gravimetry.
8. Determination of strength of given hydrochloric acid using pH meter.
9. Determination of strength of acids in a mixture of acids using conductivity meter.
10. Conductometric titration of barium chloride against sodium sulphate (precipitation titration)
11. Estimation of iron content of the given solution using potentiometer.
12. Estimation of sodium /potassium present in water using flame photometer.
13. Preparation of nanoparticles ($\text{TiO}_2/\text{ZnO}/\text{CuO}$) by Sol-Gel method.
14. Estimation of Nickel in steel
15. Proximate analysis of Coal

TOTAL : 30 PERIODS**OUT COMES :**

- To analyse the quality of water samples with respect to their acidity, alkalinity, hardness and DO.
- To determine the amount of metal ions through volumetric and spectroscopic techniques
- To analyse and determine the composition of alloys.
- To learn simple method of synthesis of nanoparticles
- To quantitatively analyse the impurities in solution by electroanalytical techniques

TEXT BOOK:

1. J. Mendham, R. C. Denney, J.D. Barnes, M. Thomas and B. Sivasankar, Vogel's Textbook of Quantitative Chemical Analysis (2009).

HS3251**PROFESSIONAL ENGLISH - II****L T P C****3 1 0 4****COURSE OBJECTIVES**

- To engage learners in meaningful language activities to improve their LSRW skills
- To enhance learners' awareness of general rules of writing for specific audiences
- To help learners understand the purpose, audience, contexts of different types of writing
- To develop analytical thinking skills for problem solving in communicative contexts
- To demonstrate an understanding of job applications and interviews for internship and placements

UNIT I MAKING COMPARISONS**12**

Listening – Evaluative Listening: Advertisements, Product Descriptions, -Audio / video; Listening and filling a Graphic Organiser (Choosing a product or service by comparison). **Speaking** – Marketing a product, Persuasive Speech Techniques. **Reading** - Reading advertisements, user manuals, brochures; **Writing** – Professional emails, Email etiquette - Compare and Contrast Essay; **Grammar** – Mixed Tenses, Prepositional phrases. **Vocabulary** – Contextual meaning of words

UNIT II EXPRESSING CAUSAL RELATIONS IN SPEAKING AND WRITING 12

Listening - Listening to longer technical talks and completing– gap filling exercises. Listening technical information from podcasts – Listening to process/event descriptions to identify cause & effects - **Speaking** – Describing and discussing the reasons of accidents or disasters based on news reports. **Reading** - Reading longer technical texts– Cause and Effect Essays, and Letters / emails of complaint, **Writing** - Writing responses to complaints. **Grammar** - Active Passive Voice transformations, Infinitive and Gerunds **Vocabulary** – Word Formation (Noun-Verb-Adj-Adv), Adverbs.

UNIT III PROBLEM SOLVING 12

Listening – Listening to / Watching movie scenes/ documentaries depicting a technical problem and suggesting solutions. **Speaking** – Group Discussion (based on case studies), - techniques and Strategies, **Reading** - Case Studies, excerpts from literary texts, news reports etc., **Writing** – Letter to the Editor, Checklists, Problem solution essay / Argumentative Essay **Grammar** – Error correction; If conditional sentences. **Vocabulary** - Compound Words, Sentence Completion.

UNIT IV REPORTING OF EVENTS AND RESEARCH 12

Listening – Listening Comprehension based on news reports – and documentaries – Precis writing, Summarising, **Speaking** –Interviewing, Presenting an oral report, Mini presentations on select topics; **Reading** –Newspaper articles; **Writing** – Recommendations, Transcoding, Accident Report, Survey Report **Grammar** – Reported Speech, Modals **Vocabulary** – Conjunctions- use of prepositions

UNIT V THE ABILITY TO PUT IDEAS OR INFORMATION COGENTLY 12

Listening – Listening to TED Talks, Presentations, Formal job interviews, (analysis of the interview performance); **Speaking** – Participating in a Role play, (interview/telephone interview), virtual interviews, Making presentations with visual aids; **Reading** – Company profiles, Statement of Purpose, (SOP), an excerpt of interview with professionals; **Writing** – Job / Internship application – Cover letter & Resume; **Grammar** – Numerical adjectives, Relative Clauses **Vocabulary** – Idioms.

TOTAL : 60 PERIODS**COURSE OUTCOMES:**

At the end of the course, learners will be able

CO1 : To compare and contrast products and ideas in technical texts.

CO2 : To identify cause and effects in events, industrial processes through technical texts

CO3 : To analyze problems in order to arrive at feasible solutions and communicate them orally and in the written format.

CO4 : To report events and the processes of technical and industrial nature.

CO5 : To present their opinions in a planned and logical manner, and draft effective resumes in context of job search.

TEXT BOOKS

1. English for Engineers & Technologists (2020 edition) Orient Blackswan Private Ltd. Department of English, Anna University.
2. English for Science & Technology Cambridge University Press 2021. Dr. Veena Selvam, Dr. Sujatha Priyadarshini, Dr. Deepa Mary Francis, Dr. KN. Shoba, and Dr. Lourdes Jevani, Department of English, Anna University.

REFERENCES

1. Raman. Meenakshi, Sharma. Sangeeta (2019). Professional English. Oxford university press. New Delhi.
2. Improve Your Writing ed. V.N. Arora and Laxmi Chandra, Oxford Univ. Press, 2001, New Delhi.
3. Learning to Communicate – Dr. V. Chellammal. Allied Publishers, New Delhi, 2003
4. Business Correspondence and Report Writing by Prof. R.C. Sharma & Krishna Mohan, Tata McGraw Hill & Co. Ltd., 2001, New Delhi.
5. Developing Communication Skills by Krishna Mohan, Meera Bannerji- Macmillan India Ltd. 1990, Delhi.

MA3251**STATISTICS AND NUMERICAL METHODS****L T P C****3 1 0 4****OBJECTIVES:**

- This course aims at providing the necessary basic concepts of a few statistical and numerical methods and give procedures for solving numerically different kinds of problems occurring in engineering and technology.
- To acquaint the knowledge of testing of hypothesis for small and large samples which plays an important role in real life problems.
- To introduce the basic concepts of solving algebraic and transcendental equations.
- To introduce the numerical techniques of interpolation in various intervals and numerical techniques of differentiation and integration which plays an important role in engineering and technology disciplines.
- To acquaint the knowledge of various techniques and methods of solving ordinary differential equations.

UNIT I TESTING OF HYPOTHESIS**9+3**

Sampling distributions - Tests for single mean, proportion and difference of means (Large and small samples) – Tests for single variance and equality of variances – Chi square test for goodness of fit – Independence of attributes.

UNIT II DESIGN OF EXPERIMENTS**9+3**

One way and two way classifications - Completely randomized design – Randomized block design – Latin square design - 2^2 factorial design.

UNIT III SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS**9+3**

Solution of algebraic and transcendental equations - Fixed point iteration method – Newton Raphson method- Solution of linear system of equations - Gauss elimination method – Pivoting - Gauss Jordan method – Iterative methods of Gauss Jacobi and Gauss Seidel - Eigenvalues of a matrix by Power method and Jacobi's method for symmetric matrices.

UNIT IV INTERPOLATION, NUMERICAL DIFFERENTIATION AND NUMERICAL INTEGRATION**9+3**

Lagrange's and Newton's divided difference interpolations – Newton's forward and backward difference interpolation – Approximation of derivatives using interpolation polynomials – Numerical single and double integrations using Trapezoidal and Simpson's 1/3 rules.

UNIT V NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS 9+3

Single step methods: Taylor's series method - Euler's method - Modified Euler's method - Fourth order Runge-Kutta method for solving first order differential equations - Multi step methods: Milne's and Adams - Bash forth predictor corrector methods for solving first order differential equations.

TOTAL: 60 PERIODS**OUTCOMES:**

Upon successful completion of the course, students will be able to:

- Apply the concept of testing of hypothesis for small and large samples in real life problems.
- Apply the basic concepts of classifications of design of experiments in the field of agriculture.
- Appreciate the numerical techniques of interpolation in various intervals and apply the numerical techniques of differentiation and integration for engineering problems.
- Understand the knowledge of various techniques and methods for solving first and second order ordinary differential equations.
- Solve the partial and ordinary differential equations with initial and boundary conditions by using certain techniques with engineering applications.

TEXT BOOKS:

1. Grewal, B.S., and Grewal, J.S., "Numerical Methods in Engineering and Science", Khanna Publishers, 10th Edition, New Delhi, 2015.
2. Johnson, R.A., Miller, I and Freund J., "Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 8th Edition, 2015.

REFERENCES:

1. Burden, R.L and Faires, J.D, "Numerical Analysis", 9th Edition, Cengage Learning, 2016.
2. Devore. J.L., "Probability and Statistics for Engineering and the Sciences", Cengage Learning, New Delhi, 8th Edition, 2014.
3. Gerald. C.F. and Wheatley. P.O. "Applied Numerical Analysis" Pearson Education, Asia, New Delhi, 7th Edition, 2007.
4. Gupta S.C. and Kapoor V. K., " Fundamentals of Mathematical Statistics", Sultan Chand & Sons, New Delhi, 12th Edition, 2020.
5. Spiegel. M.R., Schiller. J. and Srinivasan. R.A., "Schaum's Outlines on Probability and Statistics ", Tata McGraw Hill Edition, 4th Edition, 2012.
6. Walpole. R.E., Myers. R.H., Myers. S.L. and Ye. K., "Probability and Statistics for Engineers and Scientists", 9th Edition, Pearson Education, Asia, 2010.

PH3257**PHYSICS FOR TEXTILE TECHNOLOGISTS****L T P C
3 0 0 3****COURSE OBJECTIVES:**

- To make the students effectively to understand the basics of crystallography and crystal imperfections.
- To enable the students to get knowledge on ferrous and nonferrous alloys.
- To impart knowledge on the basics of ceramics, composites and nanomaterials.
- To learn about mechanical properties of materials.
- To introduce the concept of light - matter interactions and electro-optical effects.

UNIT I CRYSTALLOGRAPHY 9

Crystal structures: Crystal lattice – basis - unit cell and lattice parameters – crystal systems and Bravais lattices – Structure and packing fractions of SC, BCC, FCC, diamond cubic, NaCl, ZnS structures – crystal planes, directions and Miller indices – distance between successive planes – linear and planar densities – crystalline and noncrystalline materials –Example use of Miller indices: wafer surface orientation – wafer flats and notches – pattern alignment - imperfections in crystals.

UNIT II FERROUS AND NONFERROUS ALLOYS**9**

The Fe-Fe₃C phase diagram: phases, invariant reactions, development of microstructure in eutectoid, hypoeutectoid and hypereutectoid alloys – influence of other alloying elements in the Fe-C system - phase transformations – isothermal transformation diagram for eutectoid iron-carbon alloy – microstructures: pearlite, bainite, spheroidite and martensite – steels, stainless steels and cast irons – copper alloys – aluminum alloys – titanium alloys.

UNIT III CERAMICS, COMPOSITES AND NANO MATERIALS**9**

Ceramics – types and applications-refractories, abrasives and cements – Composites: classification, role of matrix and reinforcement -Fiber reinforced composites – carbon-carbon composites –Nanomaterials: types, physical, chemical and mechanical properties - carbon nanotubes: properties and applications - synthesis of nanomaterials: sonochemical, molecular epitaxy, physical vapor deposition (PVD) and chemical vapor deposition (CVD). Characterization: Transmission electron microscopy - scanning electron microscopy - Atomic force microscopy - X-ray powder diffraction - Nanoparticle size calculation.

UNIT IV MECHANICAL PROPERTIES**9**

Tensile test - plastic deformation by slip – slip systems – mechanisms of strengthening in metals: strain hardening, grain size reduction, solid solution strengthening, precipitation hardening – Creep: creep curves, stress and temperature effects, mechanisms of creep, creep-resistant materials – Fracture: ductile and brittle fractures - the Griffith criterion – fracture toughness - Fatigue failure: the S-N curve – factors that affect fatigue life – Hardness: Rockwell and Brinell hardness tests, Knoop and Vickers microhardness tests.

UNIT V OPTICAL PROPERTIES OF MATERIALS**9**

Light waves in a homogeneous medium - refractive index - dispersion: refractive index-wave-length behaviour - group velocity and group index – NLO materials – phase matching - SHG, sum frequency generation, parametric oscillations – difference frequency generation (qualitative)- applications- - complex refractive index and light absorption - Luminescence, phosphors and white LEDs - polarization - optical anisotropy: uniaxial crystals, birefringence, dichroism - electro-optic effect and amplitude modulators

TOTAL: 45 PERIODS**COURSE OUTCOMES:**

Upon completion of this course, the students should be able to

CO1 : Understand the basics of crystallography and its importance in materials properties

CO2 : Understand the basics of crystallography and crystal imperfections.

CO3 : Get knowledge on ferrous and nonferrous alloys.

CO4 : Acquire knowledge on the basics of ceramics, composites and nano-materials

CO5 : Learn about the concept of light - matter interactions and electro-optical effects.

TEXT BOOKS:

1. R.Balasubramaniam, Callister's Materials Science and Engineering. Wiley (Indian Edition), 2014.
2. V.Raghavan. Materials Science and Engineering: A First Course, Prentice Hall India Learning Private Limited, 2015.
3. Safa O. Kasap, Optoelectronics and Photonics, Dorling Kindersley India, 2009

REFERENCES:

1. J.F.Shackelford. Introduction to Materials Science for Engineers. Pearson, 2015.
2. Wendelin Wright and Donald Askeland, Essentials of Materials Science and Engineering, CL Engineering, 2013.
3. William Smith and Javad Hashemi, Foundations of Materials Science and Engineering, Mc Graw-Hill Education, 2018.
4. Rajesh Mishra and Jiri Militky, Nanotechnology in Textiles: Theory and Application, Elsevier, 2018.
5. Mark Fox, Optical Properties of Solids, Oxford Univ. Press, 2012.

BE3252

**BASIC ELECTRICAL, ELECTRONICS AND INSTRUMENTATION
ENGINEERING****L T P C
3 0 0 3****OBJECTIVES :**

- To introduce the basics of electric circuits and analysis
- To impart knowledge in domestic wiring
- To impart knowledge in the basics of working principles and application of electrical machines
- To introduce analog devices and their characteristics
- To introduce the functional elements and working of sensors and transducers.

UNIT I ELECTRICAL CIRCUITS**9**

DC Circuits: Circuit Components: Conductor, Resistor, Inductor, Capacitor – Ohm's Law - Kirchhoff's Laws – Simple problems- Nodal Analysis, Mesh analysis with Independent sources only (Steady state)

Introduction to AC Circuits and Parameters: Waveforms, Average value, RMS Value, Instantaneous power, real power, reactive power and apparent power, power factor – Steady state analysis of RLC circuits (Simple problems only), Three phase supply – star and delta connection – power in three-phase systems

UNIT II MAGNETIC CIRCUITS AND ELECTRICAL INSTALLATIONS**9**

Magnetic circuits-definitions-MMF, flux, reluctance, magnetic field intensity, flux density, fringing, self and mutual inductances-simple problems.

Domestic wiring , types of wires and cables, earthing ,protective devices- switch fuse unit- Miniature circuit breaker-moulded case circuit breaker- earth leakage circuit breaker, safety precautions and First Aid

UNIT III ELECTRICAL MACHINES**9**

Construction and Working principle- DC Separately and Self excited Generators, EMF equation, Types and Applications. Working Principle of DC motors, Torque Equation, Types and Applications. Construction, Working principle and Applications of Transformer, Three phase Alternator, Synchronous motor and Three Phase Induction Motor.

UNIT IV ANALOG ELECTRONICS**9**

Resistor, Inductor and Capacitor in Electronic Circuits- Semiconductor Materials: Silicon & Germanium – PN Junction Diodes, Zener Diode –Characteristics Applications – Bipolar Junction Transistor-Biasing, JFET, SCR, MOSFET, IGBT – Types, I-V Characteristics and Applications, Rectifier and Inverters, harmonics

UNIT V SENSORS AND TRANSDUCERS**9**

Sensors, solenoids, pneumatic controls with electrical actuator, mechatronics, types of valves and its applications, electro-pneumatic systems, proximity sensors, limit switches, piezoelectric, hall effect, photo sensors, Strain gauge, LVDT, differential pressure transducer, optical and digital transducers, Smart sensors, Thermal Imagers.

TOTAL : 45 PERIODS**COURSE OUTCOMES :**

After completing this course, the students will be able to

- CO1:** Compute the electric circuit parameters for simple problems
- CO2:** Explain the concepts of domestics wiring and protective devices
- CO3:** Explain the working principle and applications of electrical machines
- CO4:** Analyze the characteristics of analog electronic devices
- CO5:** Explain the types and operating principles of sensors and transducers

TEXT BOOKS:

1. D P Kothari and I.J Nagarath, "Basic Electrical and Electronics Engineering", McGraw Hill Education (India) Private Limited, Second Edition, 2020
2. A.K. Sawhney, Puneet Sawhney 'A Course in Electrical & Electronic Measurements & Instrumentation', Dhanpat Rai and Co, 2015.
3. S.K. Bhattacharya, Basic Electrical Engineering, Pearson Education, 2019
4. James A Svoboda, Richard C. Dorf, Dorf's Introduction to Electric Circuits, Wiley,2018

REFERENCES:

1. John Bird, "Electrical Circuit theory and technology", Routledge; 2017.
2. Thomas L. Floyd, 'Electronic Devices', 10th Edition, Pearson Education, 2018.
3. Albert Malvino, David Bates, 'Electronic Principles, McGraw Hill Education; 7th edition, 2017
4. Muhammad H.Rashid, "Spice for Circuits and electronics", 4th Edition.,Cengage India,2019.
5. H.S. Kalsi, 'Electronic Instrumentation', Tata McGraw-Hill, New Delhi, 2010

GE3251**ENGINEERING GRAPHICS****L T P C
2 0 4 4****COURSE OBJECTIVES:**

The main learning objective of this course is to prepare the students for:

1. Drawing engineering curves.
2. Drawing freehand sketch of simple objects.
3. Drawing orthographic projection of solids and section of solids.
4. Drawing development of solids
5. Drawing isometric and perspective projections of simple solids.

CONCEPTS AND CONVENTIONS (Not for Examination)

Importance of graphics in engineering applications — Use of drafting instruments — BIS conventions and specifications — Size, layout and folding of drawing sheets — Lettering and dimensioning.

UNIT I PLANE CURVES AND FREEHAND SKETCHING**6+12**

Basic Geometrical constructions, Curves used in engineering practices: Conics — Construction of ellipse, parabola and hyperbola by eccentricity method — Construction of cycloid — construction of involutes of square and circle — Drawing of tangents and normal to the above curves.

UNIT II PROJECTION OF POINTS, LINES AND PLANE SURFACE**6+12**

Orthographic projection- principles-Principal planes-First angle projection-projection of points. Projection of straight lines (only First angle projections) inclined to both the principal planes - Determination of true lengths and true inclinations by rotating line method and traces. Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

UNIT III PROJECTION OF SOLIDS**6+12**

Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to one of the principal planes and parallel to the other by rotating object method. Visualization concepts and Free Hand sketching: Visualization principles —Representation of Three Dimensional objects — Layout of views- Freehand sketching of multiple views from pictorial views of objects.

Practicing three dimensional modeling of simple objects by CAD Software(Not for examination)

UNIT IV PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES 6+12

Sectioning of above solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other — obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids — Prisms, pyramids cylinders and cones.

Practicing three dimensional modeling of simple objects by CAD Software(Not for examination)

UNIT V ISOMETRIC AND PERSPECTIVE PROJECTIONS 6+12

Principles of isometric projection — isometric scale — Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions - Perspective projection of simple solids-Prisms, pyramids and cylinders by visual ray method.

Practicing three dimensional modeling of isometric projection of simple objects by CAD Software(Not for examination)

TOTAL: (L=30+P=60) 90 PERIODS

OUTCOMES:

On successful completion of this course, the student will be able to

- Use BIS conventions and specifications for engineering drawing.
- Construct the conic curves, involutes and cycloid.
- Solve practical problems involving projection of lines.
- Draw the orthographic, isometric and perspective projections of simple solids.
- Draw the development of simple solids.

TEXT BOOK:

1. Bhatt N.D. and Panchal V.M., “Engineering Drawing”, Charotar Publishing House, 53rd Edition, 2019.
2. Natrajan K.V., “A Text Book of Engineering Graphics”, Dhanalakshmi Publishers, Chennai, 2018.
3. Parthasarathy, N. S. and Vela Murali, “Engineering Drawing”, Oxford University Press, 2015

REFERENCES:

1. Basant Agarwal and Agarwal C.M., “Engineering Drawing”, McGraw Hill, 2nd Edition, 2019.
2. Gopalakrishna K.R., “Engineering Drawing” (Vol. I&II combined), Subhas Publications, Bangalore, 27th Edition, 2017.
3. Luzzader, Warren.J. and Duff, John M., “Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production, Eastern Economy Edition, Prentice Hall of India Pvt. Ltd, New Delhi, 2005.
4. Parthasarathy N. S. and Vela Murali, “Engineering Graphics”, Oxford University, Press, New Delhi, 2015.
5. Shah M.B., and Rana B.C., “Engineering Drawing”, Pearson Education India, 2nd Edition, 2009.
6. Venugopal K. and Prabhu Raja V., “Engineering Graphics”, New Age International (P) Limited, 2008.

Publication of Bureau of Indian Standards:

1. IS 10711 — 2001: Technical products Documentation — Size and lay out of drawing sheets.
2. IS 9609 (Parts 0 & 1) — 2001: Technical products Documentation — Lettering.
3. IS 10714 (Part 20) — 2001 & SP 46 — 2003: Lines for technical drawings.
4. IS 11669 — 1986 & SP 46 — 2003: Dimensioning of Technical Drawings.
5. IS 15021 (Parts 1 to 4) — 2001: Technical drawings — Projection Methods.

Special points applicable to University Examinations on Engineering Graphics:

1. There will be five questions, each of either or type covering all units of the syllabus.
2. All questions will carry equal marks of 20 each making a total of 100.
3. The answer paper shall consist of drawing sheets of A3 size only. The students will be permitted to use appropriate scale to fit solution within A3 size.
4. The examination will be conducted in appropriate sessions on the same day

OBJECTIVES :

The course aims to

- Gain proper understanding on spectroscopic and surface analytical techniques.
- Impart knowledge to students on the chemistry of surface and interfaces.
- Make students well versed on the chemical analysis of oils, fats, soaps & lubricants .
- Firmly establish a sound understanding on the student's mind about chemicals and auxiliaries.
- Familiarize students with the identification and characteristics of dyes and their applications.

UNIT I SPECTROSCOPIC TECHNIQUES 9

Spectroscopy: Electromagnetic spectrum - absorption of radiation - electronic, vibrational and rotational transitions. Width and intensities of spectral lines. Flame photometer, Atomic absorption spectroscopy, UV- Vis, IR spectroscopy, Scanning Electron Microscope (SEM) and Transmission Electron Microscope (TEM) - principles, instrumentation (Block diagram) and applications.

UNIT II CHEMISTRY OF INTERFACES 9

Interface region-curved interfaces-thermodynamics of surfaces - Surface film on liquids-Adsorption of gases on Solids-adsorption isotherms – types. Applications of adsorption studies-detergency, wetting, foaming , de foaming, spreading, water repellency.

UNIT III WATER TECHNOLOGY 9

Water: Sources and impurities; Significance and estimation (only mention of methods) of - turbidity, colour, pH, acidity, alkalinity, hardness, solids, chlorides, residual chlorine, sulphates, fluorides, phosphates, iron and manganese, DO, BOD, COD, nitrogen, grease, volatile acids. **Treatment of water:** Zeolites process and ion exchange demineralization; **Desalination of water:** Reverse osmosis and Electro dialysis; **Municipal water treatment:** Primary treatment and Disinfection (UV, Ozonation, break-point chlorination).

UNIT IV OILS, FATS, SOAPS & LUBRICANTS 9

Chemical constitution, Chemical analysis of oils and fats – acid, saponification and iodine values, Definitions, determinations and significance. Definition, mechanism of lubrication, preparation of petrolubes, desirable characteristics – viscosity, viscosity index, carbon residue, oxidation stability, flash and fire points, cloud and pour points, aniline point. Semisolid lubricant – greases, preparation of sodium, lithium, calcium and axle greases and uses, consistency test and drop point test. Solid lubricants – graphite and molybdenum disulphide.

UNIT V CHEMICALS AND AUXILIARIES 9

Estimation of available chlorine in hypochlorite bleach liquor. Determination of strength of hydrogen peroxide. Colorants - Theory of colour and constitution: chromophore and auxochrome, bathochromic and hypsochromic shift, classification of dyes based on application and composition. Chemistry of azo dye – synthesis of Methyl red, Methyl orange, Congo red, phenolphthalein, fluorescein and eosin

TOTAL : 45 PERIODS

COURSE OUTCOMES :

At the end of the course, the students will be able to:

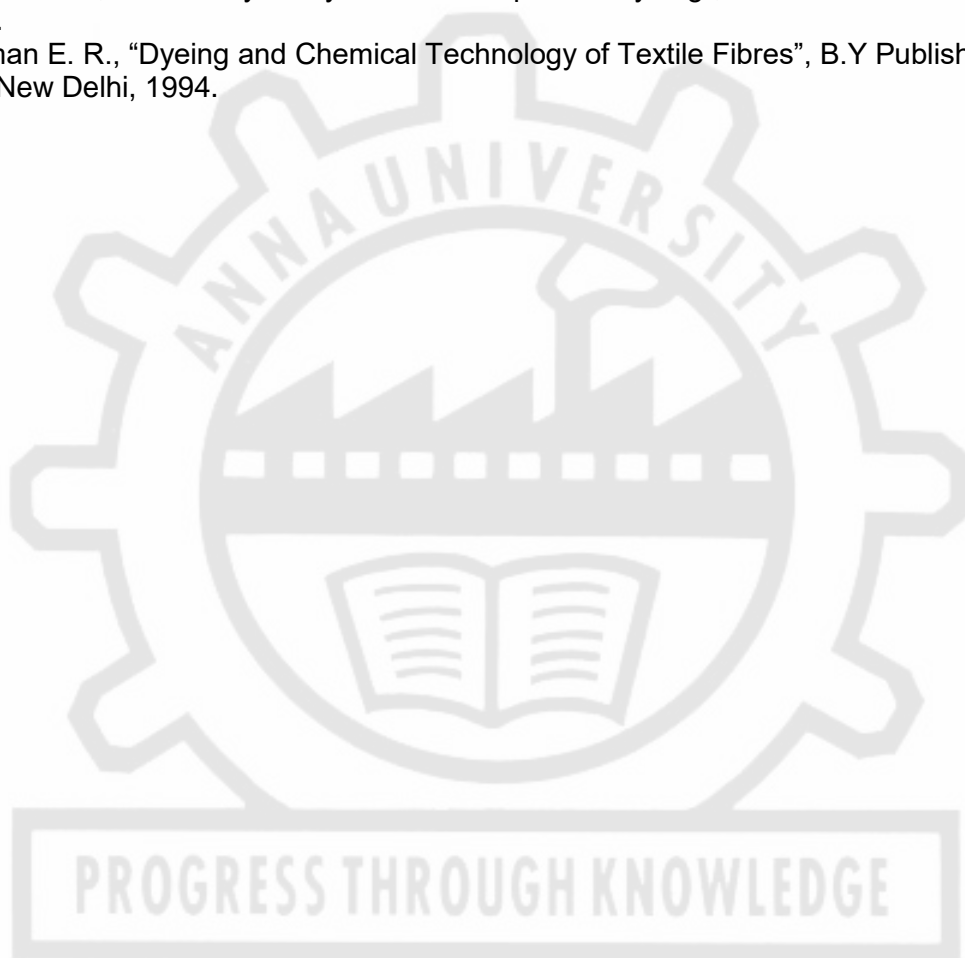
- CO1 : Understand and apply spectroscopic techniques for the analysis of engineering materials for their end use applications.
- CO2 : Make use of the applications of adsorption in detergency, wetting, spreading, foaming, de-foaming, and water repellence and separation processes.
- CO3 : Analyse and estimate oils, fats, lubricants and soap for their intended applications.
- CO4 : Distinguish and demonstrate the role of different types of chemicals and auxiliaries.
- CO5 : Realize the chemical structures, properties and relationships of different types of dyes and their applications

TEXTBOOKS:

1. Dhara S. S., "A Text Book of Engineering Chemistry", 12thEd., S. Chand & Co. Ltd., New Delhi, 2016.
2. Jain. P.C. and Monica Jain, "Engineering Chemistry", Dhanpet Rai & Sons, New Delhi, 17th Edition, 2018.
3. Shikha Agarwal, "Engineering Chemistry-Fundamentals and Applications", Cambridge University Press, Delhi, 2019.

REFERENCES:

1. B.K. Sharma, "Industrial chemistry", Krishna Prakashan Media (P) Ltd, Meerut, 2014.
2. Shore J., "Colourants and Auxiliaries: 2nd Edition, Volume 1 & 2, Wood head Publishing Ltd., 2002.
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NCC Credit Course Level 1*

NX3251	(ARMY WING) NCC Credit Course Level - I	L	T	P	C
		2	0	0	2
NCC GENERAL					6
NCC 1	Aims, Objectives & Organization of NCC				1
NCC 2	Incentives				2
NCC 3	Duties of NCC Cadet				1
NCC 4	NCC Camps: Types & Conduct				2
NATIONAL INTEGRATION AND AWARENESS					4
NI 1	National Integration: Importance & Necessity				1
NI 2	Factors Affecting National Integration				1
NI 3	Unity in Diversity & Role of NCC in Nation Building				1
NI 4	Threats to National Security				1
PERSONALITY DEVELOPMENT					7
PD 1	Self-Awareness, Empathy, Critical & Creative Thinking, Decision Making and Problem Solving				2
PD 2	Communication Skills				3
PD 3	Group Discussion: Stress & Emotions				2
LEADERSHIP					5
L 1	Leadership Capsule: Traits, Indicators, Motivation, Moral Values, Honour Code				3
L 2	Case Studies: Shivaji, Jhansi Ki Rani				2
SOCIAL SERVICE AND COMMUNITY DEVELOPMENT					8
SS 1	Basics, Rural Development Programmes, NGOs, Contribution of Youth				3
SS 4	Protection of Children and Women Safety				1
SS 5	Road / Rail Travel Safety				1
SS 6	New Initiatives				2
SS 7	Cyber and Mobile Security Awareness				1

TOTAL: 30 PERIODS

NCC Credit Course Level 1*

NX3252	(NAVAL WING) NCC Credit Course Level - I	L T	P	C
		2 0	0	2
NCC GENERAL				6
NCC 1	Aims, Objectives & Organization of NCC			1
NCC 2	Incentives			2
NCC 3	Duties of NCC Cadet			1
NCC 4	NCC Camps: Types & Conduct			2
NATIONAL INTEGRATION AND AWARENESS				4
NI 1	National Integration: Importance & Necessity			1
NI 2	Factors Affecting National Integration			1
NI 3	Unity in Diversity & Role of NCC in Nation Building			1
NI 4	Threats to National Security			1
PERSONALITY DEVELOPMENT				7
PD 1	Self-Awareness, Empathy, Critical & Creative Thinking, Decision Making and Problem Solving			2
PD 2	Communication Skills			3
PD 3	Group Discussion: Stress & Emotions			2
LEADERSHIP				5
L 1	Leadership Capsule: Traits, Indicators, Motivation, Moral Values, Honour Code			3
L 2	Case Studies: Shivaji, Jhasi Ki Rani			2
SOCIAL SERVICE AND COMMUNITY DEVELOPMENT				8
SS 1	Basics, Rural Development Programmes, NGOs, Contribution of Youth			3
SS 4	Protection of Children and Women Safety			1
SS 5	Road / Rail Travel Safety			1
SS 6	New Initiatives			2
SS 7	Cyber and Mobile Security Awareness			1

NCC Credit Course Level 1*

NX3253 (AIR FORCE WING) NCC Credit Course Level - I		L T	P	C
		20	0	2
NCC GENERAL				6
NCC 1	Aims, Objectives & Organization of NCC			1
NCC 2	Incentives			2
NCC 3	Duties of NCC Cadet			1
NCC 4	NCC Camps: Types & Conduct			2
NATIONAL INTEGRATION AND AWARENESS				4
NI 1	National Integration: Importance & Necessity			1
NI 2	Factors Affecting National Integration			1
NI 3	Unity in Diversity & Role of NCC in Nation Building			1
NI 4	Threats to National Security			1
PERSONALITY DEVELOPMENT				7
PD 1	Self-Awareness, Empathy, Critical & Creative Thinking, Decision Making and Problem Solving			2
PD 2	Communication Skills			3
PD 3	Group Discussion: Stress & Emotions			2
LEADERSHIP				5
L 1	Leadership Capsule: Traits, Indicators, Motivation, Moral Values, Honour Code			3
L 2	Case Studies: Shivaji, Jhasi Ki Rani			2
SOCIAL SERVICE AND COMMUNITY DEVELOPMENT				8
SS 1	Basics, Rural Development Programmes, NGOs, Contribution of Youth			3
SS 4	Protection of Children and Women Safety			1
SS 5	Road / Rail Travel Safety			1
SS 6	New Initiatives			2
SS 7	Cyber and Mobile Security Awareness			1

COURSE OBJECTIVES:

- Drawing pipe line plan; laying and connecting various pipe fittings used in common household plumbing work; Sawing; planing; making joints in wood materials used in common household wood work.
- Wiring various electrical joints in common household electrical wire work.
- Welding various joints in steel plates using arc welding work; Machining various simple processes like turning, drilling, tapping in parts; Assembling simple mechanical assembly of common household equipments; Making a tray out of metal sheet using sheet metal work.
- Soldering and testing simple electronic circuits; Assembling and testing simple electronic components on PCB.

GROUP – A (CIVIL & ELECTRICAL)**PART I CIVIL ENGINEERING PRACTICES****15****PLUMBING WORK:**

- a) Connecting various basic pipe fittings like valves, taps, coupling, unions, reducers, elbows and other components which are commonly used in household.
- b) Preparing plumbing line sketches.
- c) Laying pipe connection to the suction side of a pump
- d) Laying pipe connection to the delivery side of a pump.
- e) Connecting pipes of different materials: Metal, plastic and flexible pipes used in household appliances.

WOOD WORK:

- a) Sawing,
- b) Planing and
- c) Making joints like T-Joint, Mortise joint and Tenon joint and Dovetail joint.

Wood Work Study:

- a) Studying joints in door panels and wooden furniture
- b) Studying common industrial trusses using models.

PART II ELECTRICAL ENGINEERING PRACTICES**15**

- a) Introduction to switches, fuses, indicators and lamps - Basic switch board wiring with lamp, fan and three pin socket
- b) Staircase wiring
- c) Fluorescent Lamp wiring with introduction to CFL and LED types.
- d) Energy meter wiring and related calculations/ calibration
- e) Study of Iron Box wiring and assembly
- f) Study of Fan Regulator (Resistor type and Electronic type using Diac/Triac/quadrac)
- g) Study of emergency lamp wiring/Water heater

GROUP – B (MECHANICAL AND ELECTRONICS)

PART III MECHANICAL ENGINEERING PRACTICES 15

WELDING WORK:

- a) Welding of Butt Joints, Lap Joints, and Tee Joints using arc welding.
- b) Practicing gas welding.

BASIC MACHINING WORK:

- a) (simple)Turning.
- b) (simple)Drilling.
- c) (simple)Tapping.

ASSEMBLY WORK:

- a) Assembling a centrifugal pump.
- b) Assembling a household mixer.
- c) Assembling an air conditioner.

SHEET METAL WORK:

- a) Making of a square tray

FOUNDRY WORK:

- a) Demonstrating basic foundry operations.

PART IV ELECTRONIC ENGINEERING PRACTICES 15

SOLDERING WORK:

- a) Soldering simple electronic circuits and checking continuity.

ELECTRONIC ASSEMBLY AND TESTING WORK:

- a) Assembling and testing electronic components on a small PCB.

ELECTRONIC EQUIPMENT STUDY:

- a) Study an elements of smart phone..
- b) Assembly and dismantle of LED TV.
- c) Assembly and dismantle of computer/ laptop

TOTAL : 60 PERIODS

COURSE OUTCOMES:

Upon completion of this course, the students will be able to:

- CO1 : Draw pipe line plan; lay and connect various pipe fittings used in common household plumbing work; Saw; plan; make joints in wood materials used in common household wood work.
- CO2 : Wire various electrical joints in common household electrical wire work.
- CO3 : Weld various joints in steel plates using arc welding work; Machine various simple processes like turning, drilling, tapping in parts; Assemble simple mechanical assembly of common household equipments; Make a tray out of metal sheet using sheet metal work.
- CO4 : Solder and test simple electronic circuits; Assemble and test simple electronic components on PCB.

BE3272	BASIC ELECTRICAL, ELECTRONICS AND INSTRUMENTATION ENGINEERING LABORATORY	L T P C 0 0 4 2
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COURSE OBJECTIVES:

- To train the students in conducting load tests electrical machines
- To gain practical experience in experimentally obtaining the characteristics of electronic devices and rectifiers
- To train the students to measure three phase power and displacement

LIST OF EXPERIMENTS

1. Verification of ohms and Kirchhoff's Laws.
2. Three Phase Power Measurement
3. Load test on DC Shunt Motor.
4. Load test on Self Excited DC Generator
5. Load test on Single phase Transformer
6. Load Test on Induction Motor
7. Characteristics of PN and Zener Diodes
8. Characteristics of BJT, SCR and MOSFET
9. Design and analysis of Half wave and Full Wave rectifiers
10. Measurement of displacement of LVDT

TOTAL: 60 PERIODS

COURSE OUTCOMES:

After completing this course, the students will be able to

- CO1:** Use experimental methods to verify the Ohm's law and Kirchhoff's Law and to measure three phase power
- CO2:** Analyze experimentally the load characteristics of electrical machines
- CO3:** Analyze the characteristics of basic electronic devices
- CO4:** Use LVDT to measure displacement



ANNA UNIVERSITY, CHENNAI
NON-AUTONOMOUS COLLEGES AFFILIATED COLLEGES
REGULATIONS 2021
CHOICE BASED CREDIT SYSTEM

B. TECH. TEXTILE CHEMISTRY

1. Programme Educational Objectives (PEOs)

Bachelor of Textile Chemistry curriculum is designed to prepare the graduates having attitude and knowledge to

- a) Have powerful base to pursue a successful professional and technical career
- b) Have strong foundation in basic sciences, mathematics, engineering and experimentation skills to comprehend the manufacturing processes and provide practical and innovative solutions.
- c) Have knowledge on the theory and practices in the field of textile chemistry and allied areas to manage textile chemical processing industry and provide techno-economic solutions to the problems.
- d) Engross in life-long learning to keep abreast with emerging technology
- e) Practice and inspire high ethical values and maintain high technical standards

2. Programme Outcome (POs)

1. Apply knowledge of the fundamental principles of mathematics, science and textile wet processing to solve complex technological problems.
2. Identify and analyse, with the aid of relevant research surveys, complex technical problems related to textile chemical processing using modern resources and tools and the fundamental principles of mathematics and engineering sciences
3. Apply creativity in the design of systems, components or processes related to textile chemical processing so as to meet specifications and with due consideration for public health and safety, and those related to cultural, societal and environmental issues.
4. Conduct, analyse and interpret experiments to investigate problems in textile chemical processing and apply the results to improve process and product quality Ability to communicate effectively and work in interdisciplinary groups.
5. Create, select and apply appropriate techniques, resources, and modern technological and IT

- tools in professional work related to textile chemical processing
6. Apply logical thinking derived from knowledge of textile chemical processing to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to professional work
 7. Demonstrate an understanding of the impact of professional textile chemical processing solutions in societal and environmental contexts, and display knowledge of, and the dire need for sustainability
 8. Apply ethical principles and commit to professional ethics and responsibilities, and norms of professional practice
 9. Function effectively as an individual, and as a member or leader in diverse teams working in textile / garment / textile processing related projects, and in multidisciplinary settings
 10. Communicate effectively with the professional community, comprehend and write effective reports, give and receive clear instructions, and make professional presentations effectively
 11. Apply knowledge of management principles in project management, finance and continuous improvement in professions related to textile chemical processing
 12. Recognise the need for, and display ability to engage in lifelong learning to keep in line with changing technology.

3. PROGRAM SPECIFIC OUTCOMES (PSOs):

By the completion of Textile Chemistry program, the student will have following program specific Outcomes.

1. Foundational knowledge to make a successful career in textile wet processing and textile products sectors.
2. Adequate soft and communication skills to effectively face industry and society.
3. Graduates with professional ethics and social responsibility.
4. Graduates with ability to understand problems of the textile wet processing sector and design and develop solutions.

PEO's – PO's & PSO's MAPPING:

PEO	PO's												PSO's			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
a	3	2	3	2	2	3	-	1	2	1	1	2	3	-	-	1
b	3	2	2	3	-	-	3	-	-	-	-	-	2	2	-	3
c	-	-	2	3	2	-	-	-	-	-	-	-	3	2	1	3
d	-	3	2	-	-	-	-	-	-	-	-	3	1	-	-	-
e	-	-	-	-	-	-	-	3	-	-	-	-	-	1	3	-

PROGRAM ARTICULATION MATRIX

	Course Name	PO												PSO				
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	
YEAR I	SEMESTER I	Professional English - I																
		Matrices and Calculus																
		Engineering Physics																
		Engineering Chemistry																
		Problem Solving and Python Programming																
		Problem Solving and Python Programming Laboratory																
		Physics and Chemistry Laboratory																
	SEMESTER II	Professional English - II																
		Statistics and Numerical Methods																
		Physics for Textile Technologists																
		Basic Electrical, Electronics and Instrumentation Engineering																
		Engineering Graphics																
		Chemistry for Textile Technologists																
		Engineering Practices Laboratory																
SEMESTER III	Probability and Statistical Methods																	
	Polymer And organic Chemistry	1.4	1.5	1	1	1.3	1.4	1.2	1	1	1	0.5	1	2.2	1.2	1.8	1.6	
	Preparation of Textiles for Coloration	1.5	2	1.8	2	1.2	1.7	2.2	1.7	2	1.5	0.5	1.6	2	1.4	2	1.4	
	Structure and Properties of Fibres	1.6	2	1	1.8	1	2	1.5	0.5	1	1.6	0.5	1.6	1.8	1.2	1.4	1.4	
	Technology of Yarn and Fabric Manufacturing	2.4	2.4	2.2	2.4	1.4	1.4	1.4	2.2	2.4	2.2	2.2	2.2	3	2	3	2.4	
	Chemistry of Textile Auxiliaries	2.4	1.8	1.2	1	1.4	2	1.6	1.6	1.3	1.2	1	2	1.8	1.4	1.4	2	
	Yarn and Fabric Manufacturing	2.4	1.6	1.4	1.6	1.5	1.6	1.6	1.2	2	1.6	1.2	2.2	2.4	1.2	1.6	2.2	

YEAR III	SEMESTER IV	Laboratory																
		Fibre Science Laboratory	2.6	2.2	2	1.4	1.2	1	2	1.4	1	2	1	1	2.8	2.2	2	2
	SEMESTER IV	Chemistry and Technology of Intermediates and Dyes	2.4	1.8	1.2	1	1.4	2	1.6	1.6	1	1.2	1	2	2.2	1.4	1.6	2
		Physical Testing of Textile Materials	2.4	2.4	2.2	2.8	1.8	1.6	-	1.6	-	2.6	2.6	-	2.6	3	3	2.4
		Principles and Theory of Dyeing	2.6	2.2	1.6	1.6	1.4	1.6	1.8	1.8	2	1.6	1.2	2.2	2.4	1.6	2.4	2.4
		Dyeing of Cellulosic and Protein Materials	2.6	2.2	1.4	1.8	1.6	1.4	1.6	1.6	1.2	1.6	1.6	2.2	2.6	2.2	1.2	2.2
		Technology of Printing	2.4	2.2	1.6	1.2	2	1.6	1.4	1.6	1	1.8	1.6	2.2	2.4	1.6	2.2	2.4
		Environmental Science and Sustainability																
		Physical Testing of textile Material Laboratory	2	1.4	1.6	2	1.4	1	2	1	1	1.8	1.4	2	2.4	1.4	1.4	2
		Wet Processing Preparation Laboratory	2	1.8	2.6	1.6	1	1.6	1.2	2	1.6	2	2	1	3	2	2	1.6
Textile Chemical Analysis Laboratory		2	1.4	1.2	1.8	1.2	1.8	1.6	1.4	1.4	1.6	1.2	2	2.4	1.8	1	2	
YEAR III	SEMESTER V	Production and Dyeing of Synthetic Materials	3	3	2	2	1.4	1.4	1.8	1.4	2	2	2	2	3	2.6	1.4	2.8
		Life Skills and Soft Skills																
		Textile Dyeing and Printing Laboratory	2.6	2.4	1.6	1.8	1.8	1.2	1.6	1.6	1.6	1.4	1	2	2.2	2	1	2
		Shade Matching And Quality Control Laboratory	2.6	1.8	2.6	1.6	1	1.6	1.2	2	1.6	2	2	1	3	2	1.6	2
	SEMESTER VI	Textile Finishing	2.6	2.8	2	2	1.4	1.4	1.8	1.4	2	2	1	2	3	2.6	1	2.8
		Eco-Friendly dyes, chemicals and Processing	2.6	2	1.8	1.4	1.2	2	2	1.2	1.6	1.8	1	2.2	2	1.6	2	2.6
		Dyeing of Synthetic Textile Laboratory	3	2.4	1.6	1.8	1.8	1	1.6	1.6	1.6	1.4	1	2	2.2	2	1	2
		Textile Finishing Laboratory	2	1.6	1.4	1.2	1.8	1.4	1.6	1.6	2	1.6	1	2	2.4	1.6	1.4	2.2
YEAR IV	SEMESTER VII	Effluent Treatment and Pollution Control	2.4	1.6	1.4	1.6	1.4	1.2	1.8	1.6	1.4	1.6	1	1.8	2.4	2	1.2	2.2
		Process and Quality control in Textile Wet Processing	2.4	1.8	1.2	1	1.4	2	1.6	1.6	1	1.2	1	2	2.2	1.4	1.6	2
		Ethics and Human values																
		Elective –																

SEMESTER VIII	Management																
	Summer Internship	3	2	2.6	2.8	2	2	2.1	2.1	3	2.4	2.6	2.6	2.8	2.4	1	2
	Project Work	3	3	3	3	1	1	1	2	2	2	2	1	3	2	1	3

Course Name	PO												PSO			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
Manufacturing and Processing of Knitted fabric	3	2.4	2	2.4	1.8	2	2	2	1	2	2	2.4	2	3	3	2.4
Nanotechnology in Textile Processing	2.6	2.8	2	2	1.4	1.4	1.8	1.4	2	2	1	2	3	2.6	2.8	1.4
Coated and Laminated Textiles	1.8	1.4	1.8	1.8	1	1.4	1.4	1.4	1.4	1.8	1	1.8	2	2.4	1	3
Functional Finishes	2.6	2.8	2	2	1.4	1.4	1.8	1.4	2	2	1	2	3	2.6	1.4	2.8
Modern Printing Technology	2.4	2.2	1.6	1.2	2	2	1.4	1.6	1	1.8	1.6	2	2.4	1.6	2.2	2.4
Advanced Wet Processing Machineries	2.2	1	1	2.6	1	2.4	2.4	2	1	1	1	1.6	2	2	1	3
Instrumental Methods of Chemical Analysis	2.6	2	1.4	1.4	1.8	2	1.6	1.4	1.6	1.8	1	2	2.4	2.2	1.4	2.6
Computer colour Matching	2	1.6	1.4	1.2	1.8	1.4	1.6	1.6	2	1.6	1	2	2.4	1.6	1.4	2.2
Garment Manufacturing Technology	1.6	1.2	1	0.8	1.4	0.8	1.4	1	0.2	1.8	2.4	1	1.8	2.6	1	2.6
Garment And Denim Processing	3	3	2	2	1.4	1.4	1.8	1.4	2	2	2	2	3	2.6	1.4	2.8
Apparel Production Planning and Control	-	1	2.6	2	2	1	1	2.4	2	1.2	1	-	2	2	2	2
Apparel Costing	-	-	1	-	2.2	1	-	2	2	-	2	0.4	-	2	2	-
Retail	-	-	1	-	2.2	-	-	1.6	2	2.4	3	2	-	1	1	1

Management And Visual Merchandising																	
Sustainable Textiles	1	-	2	1	2	2.4	1.4	-	1	2	-	2.6	2.2	2	1	2.2	
Enterprise Resource Planning for Garment Industry	-	-	2.2	-	3	-	-	2	2	1	2.4	1	-	2	1	-	
Industrial Engineering in Textile Industry	1.2	2	3	3	2	1	1.2	2	2	1	2.4	2	1	1	-	1	
Supply Chain Management	-	-	2.4	1.4	2.4	-	-	2	2.4	2	2.4	1	2	1	-	1	
Brand Management	-	-	1	1.4	2	-	-	1	2.4	2	2.4	1	2	1	2	1	
Apparel Entrepreneurship	-	-	1.2	1.4	1	-	-	1.4	2	1	3	2	1.6	1	1	2	
Financial Management in Textile Industry	-	-	2.4	-	2.6	1	-	2	2	2	2.4	1	-	2	1	-	
Textile Export Marketing	-	-	2.4	-	2.6	1.6	-	1	2	2	2.4	1	-	2	1	-	
Textile EXIM Management	-	1.2	2	1	2.6	-	-	2	2.2	1.2	2.2	1	2	1	-	1	
Energy Management and Conservation in Textile Industry	-	-	2	-	1	-	1.6	1.6	2	2	2.6	1.8	-	1	-	1	
Operations Research In Textile Industry	-	-	2	-	3	-	-	1	2	1	2	-	-	1	-	1	
Bonded Fabrics	2.4	2.4	2.2	2.8	1.8	1.6	-	1.6	-	2.6	2.6	1	2.6	3	3	2.4	
Smart textiles	-	-	2.2	-	-	2.2	2.2	2	1	2	2.6	1	-	3	2	2.4	
Home Textiles	1.8	2.4	2.6	2.8	1.6	2	2.2	1	1	1.8	1	1	2.4	2.2	1.8	2.6	
Technical Textiles	1.6	1.2	3	3	-	2.4	2	2	1	2	3	3	2	3	1	2.4	
Medical Textiles	1.4	2	2.8	2.6	1	2.4	2.4	2.4	1	1.4	1	2	2.4	2.2	1	2.6	
Protective Textile	-	2	3	2.2	-	1.6	1.6	1.8	1	1.2	1	1.6	2	1.4	1	2	
Recycling in Textiles	2	1.2	1.6	1.4	2.2	1.8	1.2	1.4	1.6	1.6	1.6	2.4	2.2	1.6	1.2	2.4	
High Performance Fibres	1.4	2.8	2	3	1	1	1	1	1	2	2	1	2	1.4	1.8	3	

**ANNA UNIVERSITY,
NON-AUTONOMOUS COLLEGES AFFILIATED COLLEGES
REGULATIONS 2021
B. TECH. TEXTILE CHEMISTRY
CHOICE BASED CREDIT SYSTEM
CURRICULUM FOR SEMESTERS I TO VIII AND SYLLABI FOR SEMESTERS III AND IV**

SEMESTER I

S. No.	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	IP3151	Induction Programme	-	-	-	-	-	0
THEORY								
2.	HS3151	Professional English - I	HSMC	3	0	0	3	3
3.	MA3151	Matrices and Calculus	BSC	3	1	0	4	4
4.	PH3151	Engineering Physics	BSC	3	0	0	3	3
5.	CY3151	Engineering Chemistry	BSC	3	0	0	3	3
6.	GE3151	Problem Solving and Python Programming	ESC	3	0	0	3	3
7.	GE3172	அறிவியல் தமிழ் / Scientific Thoughts in Tamil	HSMC	1	0	0	1	1
PRACTICALS								
8.	GE3171	Problem Solving and Python Programming Laboratory	ESC	0	0	4	4	2
9.	BS3171	Physics and Chemistry Laboratory	BSC	0	0	4	4	2
10.	GE3172	English Laboratory [§]	EEC	0	0	2	2	1
TOTAL				16	1	10	27	22

§ Skill Based Course

SEMESTER II

SI. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	HS3251	Professional English - II	HSMC	2	0	0	2	2
2.	MA3251	Statistics and Numerical Methods	BSC	3	1	0	4	4
3.	PH3257	Physics for Textile Technologists	BSC	3	0	0	3	3
4.	BE3252	Basic Electrical, Electronics and Instrumentation Engineering	ESC	3	0	0	3	3
5.	GE3251	Engineering Graphics	ESC	2	0	4	6	4
6.	CY3252	Chemistry for Textile Technologists	BSC	3	0	0	3	3
7.	GE3252	தமிழர் மரபு / Heritage of Tamils	HSMC	1	0	0	1	1
8.		NCC Credit Course Level 1*	-	2	0	0	2	2
PRACTICALS								
9.	GE3271	Engineering Practices Laboratory	ESC	0	0	4	4	2
10.	BE3272	Basic Electrical, Electronics and Instrumentation Engineering Laboratory	ESC	0	0	4	4	2
11.	GE3272	Communication Laboratory / Foreign Language §	EEC	0	0	4	4	2
TOTAL				17	1	16	34	26

NCC Credit Course level 1 is offered for NCC students only. The grades earned by the students will be recorded in the Mark Sheet, however the same shall not be considered for the computation of CGPA.

§ Skill Based Course

SEMESTER III

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	MA3357	Probability and Statistical Methods	BSC	3	1	0	4	4
2.	TC3301	Polymer and organic Chemistry	ESC	3	0	0	3	3
3.	TC3302	Preparation of Textiles for Coloration	PCC	3	0	0	3	3
4.	TC3303	Structure and Properties of Fibres	PCC	3	0	0	3	3
5.	TC3304	Technology of Yarn and Fabric Manufacturing	PCC	3	0	0	3	3
6.	TC3305	Chemistry of Textile Auxiliaries	PCC	3	0	0	3	3
PRACTICALS								
7.	TC3311	Yarn and Fabric Manufacturing Laboratory	PCC	0	0	3	3	1.5
8.	TC3312	Fibre Science Laboratory	PCC	0	0	2	2	1
9.	GE33361	Professional Development§	EEC	0	0	2	2	1
TOTAL				18	1	7	26	22.5

\$ Skill Based Course

SEMESTER IV

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	TC3401	Chemistry and Technology of Intermediates and Dyes	PCC	3	0	0	3	3
2.	TT3591	Testing of Textile Materials	PCC	3	0	0	3	3
3.	TC3402	Principles and Theory of Dyeing	PCC	3	0	0	3	3
4.	TC3403	Dyeing of Cellulosic and Protein Materials	PCC	3	0	0	3	3
5.	TC3404	Technology of Printing	PCC	3	0	0	3	3
6.	GE3451	Environmental Sciences and Sustainability	BSC	2	0	0	2	2
7.		NCC Credit Course Level 2#		3	0	0	3	3 #
PRACTICALS								
8.	TT3581	Testing of textile Material Laboratory	PCC	0	0	3	3	1.5
9.	TC3411	Wet Processing Preparation Laboratory	PCC	0	0	3	3	1.5
10.	TC3412	Textile Chemical Analysis Laboratory	PCC	0	0	3	3	1.5
11.	TC3513	Industrial Training/Internship I*	EEC	-	-	-	-	-
TOTAL				17	0	9	26	21.5

NCC Credit Course level 2 is offered for NCC students only. The grades earned by the students will be recorded in the Mark Sheet, however the same shall not be considered for the computation of CGPA.

*Four weeks industrial training/internship carries two credits. Industrial training/internship during IV Semester Summer Vacation will be evaluated in V semester

PROGRESS THROUGH KNOWLEDGE

SEMESTER V

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	TC3501	Production and Dyeing of Synthetic Textiles	PCC	3	0	0	3	3
2.		Professional Elective I	PEC	3	0	0	3	3
3.		Professional Elective II	PEC	3	0	0	3	3
4.		Professional Elective III	PEC	3	0	0	3	3
5.		Professional Elective IV	PEC	3	0	0	3	3
6.		Mandatory Course-I ^{&}	MC	3	0	0	3	0
PRACTICALS								
7.	TC3511	Textile Dyeing and Printing Laboratory	PCC	0	0	3	3	1.5
8.	TC3512	Shade Matching And Quality Control Laboratory	PCC	0	0	3	3	1.5
9.	TC3513	Industrial Training/Internship I**	EEC	0	0	0	0	2
TOTAL				15	0	6	21	20

[&] Mandatory Course-I is a Non-credit Course (Student shall select one course from the list given under MC-I)

**Four weeks industrial training/internship carries two credits. Industrial training/internship during IV Semester Summer Vacation will be evaluated in V semester

SEMESTER VI

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	TC3601	Textile Finishing	PCC	3	0	0	3	3
2.	TC3602	Eco-Friendly dyes, chemicals and Processing	PCC	3	0	0	3	3
3.	TC3603	Financial management for textile industry	PCC	3	0	0	3	3
4.		Open Elective – I*	OEC	3	0	0	3	3
5.		Professional Elective V	PEC	3	0	0	3	3
6.		Professional Elective VI	PEC	3	0	0	3	3
7.		Mandatory Course II ^{&}	MC	3	0	0	3	0
8.		NCC Credit Course Level 3#		3	0	0	3	3 #
PRACTICALS								
9.	TC3611	Dyeing of Synthetic Textile Laboratory	PCC	0	0	3	3	1.5
10.	TC3612	Textile Finishing Laboratory	PCC	0	0	3	3	1.5
11.	TC3711	Industrial Training/Internship II**	EEC	-	-	-	-	-
TOTAL				21	0	6	27	21

*Open Elective – I shall be chosen from the emerging technologies.

**Two weeks industrial training/internship carries one credit. Industrial training/Internship during VI Semester Summer Vacation will be evaluated in VII semester

& Mandatory Course-II is a Non-credit Course (Student shall select one course from the list given under MC- II)

NCC Credit Course level 3 is offered for NCC students only. The grades earned by the students will be recorded in the Mark Sheet, however the same shall not be considered for the computation of CGPA.

SEMESTER VII/VIII*

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	TC3701	Effluent Treatment and Pollution Control	PCC	3	0	0	3	3
2.	TC3702	Process and Quality control in Textile Wet Processing	PCC	3	0	0	3	3
3.	GE3791	Human values and Ethics	HSMC	2	0	0	2	2
4.		Elective – Management [#]	HSMC	3	0	0	3	3
5.		Open Elective – II ^{**}	OEC	3	0	0	3	3
6.		Open Elective – III ^{***}	OEC	3	0	0	3	3
7.		Open Elective – IV ^{***}	OEC	3	0	0	3	3
PRACTICALS								
8.	TC3711	Industrial Training/Internship II ^{##}	EEC	-	-	-	-	2
TOTAL				20	0	0	20	22

*If students undergo internship in Semester VII, then the courses offered during semester VII will be offered during semester VIII.

**Open Elective – II shall be chosen from the emerging technologies.

***Open Elective III and IV (Shall be chosen from the list of open electives offered by other Programmes)

Elective- Management shall be chosen from the Elective Management courses

##Two weeks industrial training/internship carries one credit. Industrial training/Internship during VI Semester Summer Vacation will be evaluated in VII semester

SEMESTER VIII/VII*

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
PRACTICALS								
1.	TC3811	Internship [#] / Project Work	EEC	0	0	20	20	10
TOTAL				0	0	20	20	10

*If students undergo internship in Semester VII, then the courses offered during semester VII will be offered during semester VIII.

#15 weeks of continuous Internship in an organization carries 10 credits.

TOTAL CREDITS: 165

ELECTIVE – MANAGEMENT COURSES

SL. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	GE3751	Principles of Management	HSMC	3	0	0	3	3
2.	GE3752	Total Quality Management	HSMC	3	0	0	3	3
3.	GE3753	Engineering Economics and Financial Accounting	HSMC	3	0	0	3	3
4.	GE3754	Human Resource Management	HSMC	3	0	0	3	3
5.	GE3755	Knowledge Management	HSMC	3	0	0	3	3
6.	GE3792	Industrial Management	HSMC	3	0	0	3	3

MANDATORY COURSES I

SL. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	MX3081	Introduction to Women and Gender Studies	MC	3	0	0	3	0
2.	MX3082	Elements of Literature	MC	3	0	0	3	0
3.	MX3083	Film Appreciation	MC	3	0	0	3	0
4.	MX3084	Disaster Management	MC	3	0	0	3	0

MANDATORY COURSES II

SL. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	MX3085	Well Being with traditional practices (Yoga, Ayurveda and Siddha)	MC	3	0	0	3	0
2.	MX3086	History of Science and Technology in India	MC	3	0	0	3	0
3.	MX3087	Political and Economic Thought for a Humane Society	MC	3	0	0	3	0
4.	MX3088	State, Nation Building and Politics in India	MC	3	0	0	3	0
5.	MX3089	Industrial Safety	MC	3	0	0	3	0

PROFESSIONAL ELECTIVE COURSES : VERTICALS

Vertical I Chemical Processing	Vertical II Apparel Manufacturing and Processing	Vertical III Management	Vertical IV Technical Textiles
Manufacturing and Processing of Knitted fabrics	Garment Manufacturing Technology	Supply Chain Management	Recycling in Textiles
Functional Finishes	Garment And Denim Processing	Brand Management	Technical Textiles
Modern Printing Technology	Apparel Production Planning and Process Control	Apparel Entrepreneurship	Home Textiles
Advanced Wet Processing Machineries	Industrial Engineering in Apparel Industry	Energy Management and Conservation in Textile Industry	Technology of Non wovens
Instrumental Methods of Chemical Analysis	Retail Management And Visual Merchandising	Operations Research In Textile Industry	Medical Textiles
Computer colour Matching	Enterprise Resource Planning for Garment Industry	Textile and apparel EXIM Management	Protective Textile

Registration of Professional Elective Courses from Verticals:

Professional Elective Courses will be registered in Semesters V and VI. These courses are listed in groups called verticals that represent a particular area of specialisation. Students are permitted to choose all Professional Electives from a particular vertical or from different verticals. Further, only one Professional Elective course shall be chosen in a semester horizontally (row-wise). However, two courses are permitted from the same row, provided one course is enrolled in Semester V and another in semester VI.

The registration of courses for B.E./B.Tech (Honours) or Minor degree shall be done from Semester V to VIII. The procedure for registration of courses explained above shall be followed for the courses of B.E./B.Tech (Honours) or Minor degree also. For more details on B.E./B.Tech (Honours) or Minor degree shall be obtained from Regulations 2021 Clause 4.10.

PROFESSIONAL ELECTIVE COURSES : VERTICALS**VERTICAL I: CHEMICAL PROCESSING**

SL. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	TC3001	Manufacturing and Processing of Knitted fabrics	PEC	3	0	0	3	3
2.	TC3002	Functional Finishes	PEC	3	0	0	3	3
3.	TC3003	Modern Printing Technology	PEC	3	0	0	3	3
4.	TC3004	Advanced Wet Processing Machineries	PEC	3	0	0	3	3
5.	TC3005	Instrumental Methods of Chemical Analysis	PEC	3	0	0	3	3
6.	TC3006	Computer colour Matching	PEC	3	0	0	3	3

VERTICAL II: APPAREL MANUFACTURING AND PROCESSING

SL. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	TC3007	Garment Manufacturing Technology	PEC	3	0	0	3	3
2.	TC3008	Garment And Denim Processing	PEC	3	0	0	3	3
3.	FT3591	Apparel Production Planning and Process Control	PEC	3	0	0	3	3
4.	TC3009	Industrial Engineering in Apparel Industry	PEC	3	0	0	3	3
5.	TC3010	Retail Management And Visual Merchandising	PEC	3	0	0	3	3
6.	CTT336	Enterprise Resource Planning for Garment Industry	PEC	0	0	6	3	6

VERTICAL III: MANAGEMENT

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	TC3011	Supply Chain Management	PEC	3	0	0	3	3
2.	TC3012	Brand Management	PEC	3	0	0	3	3
3.	TC3013	Apparel Entrepreneurship	PEC	3	0	0	3	3
4.	TC3014	Energy Management and Conservation in Textile Industry	PEC	3	0	0	3	3
5.	TC3015	Operations Research In Textile Industry	PEC	3	0	0	3	3
6.	TC3016	Textile EXIM Management	PEC	3	0	0	3	3

VERTICAL IV: TECHNICAL TEXTILES

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	TC3017	Recycling in Textiles	PEC	3	0	0	3	3
2.	CTT349	Technical Textiles	PEC	3	0	0	3	3
3.	CTT339	Home Textiles	PEC	3	0	0	3	3
4.	TC3018	Bonded Fabrics	PEC	3	0	0	3	3
5.	CTT340	Medical Textiles	PEC	3	0	0	3	3
6.	TC3019	Protective Textile	PEC	3	0	0	3	3

OPEN ELECTIVES

Students shall choose the open elective courses, such that the course contents are not similar to any other course contents/title under other course categories.

**OPEN ELECTIVE I AND II
(EMERGING TECHNOLOGIES)**

To be offered other than Faculty of Information and Communication Engineering

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	OCS351	Artificial Intelligence and Machine Learning Fundamentals	OEC	2	0	2	4	3
2.	OCS352	IoT Concepts and Applications	OEC	2	0	2	4	3
3.	OCS353	Data Science Fundamentals	OEC	2	0	2	4	3
4.	OCS354	Augmented and Virtual Reality	OEC	2	0	2	4	3

OPEN ELECTIVES – III

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	OHS351	English for Competitive Examinations	OEC	3	0	0	3	3
2.	OCE353	Lean Concepts, Tools And Practices	OEC	3	0	0	3	3
3.	OMG352	NGOs and Sustainable Development	OEC	3	0	0	3	3
4.	OMG353	Democracy and Good Governance	OEC	3	0	0	3	3
5.	OME353	Renewable Energy Technologies	OEC	3	0	0	3	3
6.	OME354	Applied Design Thinking	OEC	2	0	2	4	3
7.	OMF351	Reverse Engineering	OEC	3	0	0	3	3
8.	OMF353	Sustainable Manufacturing	OEC	3	0	0	3	3
9.	OAU351	Electric and Hybrid Vehicle	OEC	3	0	0	3	3
10.	OAS352	Space Engineering	OEC	3	0	0	3	3
11.	OIM351	Industrial Management	OEC	3	0	0	3	3
12.	OIE354	Quality Engineering	OEC	3	0	0	3	3
13.	OSF351	Fire Safety Engineering	OEC	3	0	0	3	3
14.	OML351	Introduction to non-destructive testing	OEC	3	0	0	3	3

15.	OMR351	Mechatronics	OEC	3	0	0	3	3
16.	ORA351	Foundation of Robotics	OEC	3	0	0	3	3
17.	OAE352	Fundamentals of Aeronautical engineering	OEC	3	0	0	3	3
18.	OGI351	Remote Sensing Concepts	OEC	3	0	0	3	3
19.	OAI351	Urban Agriculture	OEC	3	0	0	3	3
20.	OEN351	Drinking Water Supply and Treatment	OEC	3	0	0	3	3
21.	OEE352	Electric Vehicle technology	OEC	3	0	0	3	3
22.	OEI353	Introduction to PLC Programming	OEC	3	0	0	3	3
23.	OBT352	Biomedical Instrumentation	OEC	3	0	0	3	3
24.	OFD352	Traditional Indian Foods	OEC	3	0	0	3	3
25.	OFD353	Introduction to food processing	OEC	3	0	0	3	3
26.	OPY352	IPR for Pharma Industry	OEC	3	0	0	3	3
27.	OCH351	Nano Technology	OEC	3	0	0	3	3
28.	OCH352	Functional Materials	OEC	3	0	0	3	3
29.	OPE351	Introduction to Petroleum Refining and Petrochemicals	OEC	3	0	0	3	3
30.	OPE352	Energy Conservation and Management	OEC	3	0	0	3	3
31.	OPT351	Basics of Plastics Processing	OEC	3	0	0	3	3
32.	OEC351	Signals and Systems	OEC	3	0	0	3	3
33.	OEC352	Fundamentals of Electronic Devices and Circuits	OEC	3	0	0	3	3
34.	OBM351	Foundation Skills in integrated product Development	OEC	3	0	0	3	3
35.	OBM352	Assistive Technology	OEC	3	0	0	3	3
36.	OMA352	Operations Research	OEC	3	0	0	3	3
37.	OMA353	Algebra and Number Theory	OEC	3	0	0	3	3
38.	OMA354	Linear Algebra	OEC	3	0	0	3	3

OPEN ELECTIVES – IV

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	OHS352	Project Report Writing	OEC	3	0	0	3	3
2.	OCE354	Basics of Integrated Water Resources Management	OEC	3	0	0	3	3
3.	OMA355	Advanced Numerical Methods	OEC	3	0	0	3	3
4.	OMA356	Random Processes	OEC	3	0	0	3	3
5.	OMA357	Queuing and Reliability Modelling	OEC	3	0	0	3	3
6.	OMG354	Production and Operations Management for Entrepreneurs	OEC	3	0	0	3	3
7.	OMG355	Multivariate Data Analysis	OEC	3	0	0	3	3
8.	OME352	Additive Manufacturing	OEC	3	0	0	3	3
9.	OME353	New Product Development	OEC	3	0	0	3	3
10.	OME355	Industrial Design & Rapid Prototyping Techniques	OEC	2	0	2	4	3
11.	OMF352	Micro and Precision Engineering	OEC	3	0	0	3	3
12.	OMF354	Cost Management of Engineering Projects	OEC	3	0	0	3	3
13.	OAU352	Batteries and Management system	OEC	3	0	0	3	3
14.	OAU353	Sensors and Actuators	OEC	3	0	0	3	3
15.	OAS353	Space Vehicles	OEC	3	0	0	3	3
16.	OIM352	Management Science	OEC	3	0	0	3	3
17.	OIM353	Production Planning and Control	OEC	3	0	0	3	3
18.	OIE353	Operations Management	OEC	3	0	0	3	3
19.	OSF352	Industrial Hygiene	OEC	3	0	0	3	3
20.	OSF353	Chemical Process Safety	OEC	3	0	0	3	3
21.	OML352	Electrical, Electronic and Magnetic materials	OEC	3	0	0	3	3
22.	OML353	Nanomaterials and applications	OEC	3	0	0	3	3
23.	OMR352	Hydraulics and Pneumatics	OEC	3	0	0	3	3
24.	OMR353	Sensors	OEC	3	0	0	3	3
25.	ORA352	Foundation of Automation	OEC	3	0	0	3	3

26.	ORA353	Concepts in Mobile Robotics	OEC	3	0	0	3	3
27.	OMV351	Marine Propulsion	OEC	3	0	0	3	3
28.	OMV352	Marine Merchant Vehicles	OEC	3	0	0	3	3
29.	OMV353	Elements of Marine Engineering	OEC	3	0	0	3	3
30.	OAE353	Drone Technologies	OEC	3	0	0	3	3
31.	OGI352	Geographical Information System	OEC	3	0	0	3	3
32.	OAI352	Agriculture Entrepreneurship Development	OEC	3	0	0	3	3
33.	OEN352	Biodiversity Conservation	OEC	3	0	0	3	3
34.	OEE353	Introduction to control systems	OEC	3	0	0	3	3
35.	OEI354	Introduction to Industrial Automation Systems	OEC	3	0	0	3	3
36.	OBT353	Environment and Agriculture	OEC	3	0	0	3	3
37.	OFD354	Fundamentals of Food Engineering	OEC	3	0	0	3	3
38.	OFD355	Food safety and Quality Regulations	OEC	3	0	0	3	3
39.	OPY353	Nutraceuticals	OEC	3	0	0	3	3
40.	OCH353	Energy Technology	OEC	3	0	0	3	3
41.	OCH354	Surface Science	OEC	3	0	0	3	3
42.	OPE353	Industrial safety	OEC	3	0	0	3	3
43.	OPE354	Unit Operations in Petro Chemical Industries	OEC	3	0	0	3	3
44.	OPT352	Plastic Materials for Engineers	OEC	3	0	0	3	3
45.	OPT353	Properties and Testing of Plastics	OEC	3	0	0	3	3
46.	OEC353	VLSI Design	OEC	3	0	0	3	3
47.	OEC354	Industrial IoT and Industry 4.0	OEC	2	0	2	4	3
48.	OBM353	Wearable devices	OEC	3	0	0	3	3
49.	OBM354	Medical Informatics	OEC	3	0	0	3	3

SUMMARY

Name of the Programme										
S.No	Subject Area	Credits per Semester								Total Credits
		I	II	III	IV	V	VI	VII/VIII	VIII/VII	
1	HSMC	4	3	4				5		16
2	BSC	12	10		2					24
3	ESC	5	11	3						19
4	PCC			14.5	19.5	6	12	6		58
5	PEC					12	6			18
6	OEC						3	9		12
7	EEC	1	2	1		2		2	10	18
8	Non-Credit /(Mandatory)					√	√			
Total		22	26	22.5	21.5	20	21	22	10	165



PROGRESS THROUGH KNOWLEDGE

Enrollment for B.E. / B. Tech. (Honours) / Minor degree (Optional)

A student can also optionally register for additional courses (18 credits) and become eligible for the award of B.E./B.Tech. (Honours) Minor degree.

For B.E. / B. Tech. (Honours), a student shall register for the additional courses (18 credits) from semester V onwards. These courses shall be from the same vertical or a combination of different verticals of the same programme of study only.

For minor degree, a student shall register for the additional courses (18 credits) from semester V onwards. All these courses have to be in a particular vertical from any one of the other programmes, Moreover, for minor degree the student can register for courses from any one of the following verticals also.

Complete details are available in clause 4.10 of Regulations 2021.

VERTICALS FOR MINOR DEGREE (IN ADDITIONS TO ALL THE VERTICALS OF OTHER PROGRAMMES)

Vertical I Fintech and Block Chain	Vertical II Entrepreneurship	Vertical III Public Administration	Vertical IV Business Data Analytics	Vertical V Environment and Sustainability
Financial Management	Foundations of Entrepreneurship	Principles of Public Administration	Statistics For Management	Sustainable infrastructure Development
Fundamentals of Investment	Team Building & Leadership Management for Business	Constitution of India	Data Mining For Business Intelligence	Sustainable Agriculture and Environmental Management
Banking, Financial Services and Insurance	Creativity & Innovation in Entrepreneurship	Public Personnel Administration	Human Resource Analytics	Sustainable Bio Materials
Introduction to Blockchain and its Applications	Principles of Marketing Management For Business	Administrative Theories	Marketing And Social Media Web Analytics	Materials for Energy Sustainability
Fintech Personal Finance and Payments	Human Resource Management for Entrepreneurs	Indian Administrative System	Operation And Supply Chain Analytics	Green Technology
Introduction to Fintech	Financing New Business Ventures	Public Policy Administration	Financial Analytics	Environmental Quality Monitoring and Analysis
-	-	-	-	Integrated Energy Planning for Sustainable Development
-	-	-	-	Energy Efficiency for Sustainable Development

(Choice of courses for Minor degree is to be made from any one vertical of other programmes or from anyone of the following verticals)

VERTICAL 1: FINTECH AND BLOCK CHAIN

SL · N O.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	CMG331	Financial Management	PEC	3	0	0	3	3
2.	CMG332	Fundamentals of Investment	PEC	3	0	0	3	3
3.	CMG333	Banking, Financial Services and Insurance	PEC	3	0	0	3	3
4.	CMG334	Introduction to Blockchain and its Applications	PEC	3	0	0	3	3
5.	CMG335	Fintech Personal Finance and Payments	PEC	3	0	0	3	3
6.	CMG336	Introduction to Fintech	PEC	3	0	0	3	3

VERTICAL 2: ENTREPRENEURSHIP

SL. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	CMG337	Foundations of Entrepreneurship	PEC	3	0	0	3	3
2.	CMG338	Team Building & Leadership Management for Business	PEC	3	0	0	3	3
3.	CMG339	Creativity & Innovation in Entrepreneurship	PEC	3	0	0	3	3
4.	CMG340	Principles of Marketing Management For Business	PEC	3	0	0	3	3
5.	CMG341	Human Resource Management for Entrepreneurs	PEC	3	0	0	3	3
6.	CMG342	Financing New Business Ventures	PEC	3	0	0	3	3

VERTICAL 3: PUBLIC ADMINISTRATION

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	CMG343	Principles of Public Administration	PEC	3	0	0	3	3
2.	CMG344	Constitution of India	PEC	3	0	0	3	3
3.	CMG345	Public Personnel Administration	PEC	3	0	0	3	3
4.	CMG346	Administrative Theories	PEC	3	0	0	3	3
5.	CMG347	Indian Administrative System	PEC	3	0	0	3	3
6.	CMG348	Public Policy Administration	PEC	3	0	0	3	3

VERTICAL 4: BUSINESS DATA ANALYTICS

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	CMG349	Statistics For Management	PEC	3	0	0	3	3
2.	CMG350	Datamining For Business Intelligence	PEC	3	0	0	3	3
3.	CMG351	Human Resource Analytics	PEC	3	0	0	3	3
4.	CMG352	Marketing And Social Media Web Analytics	PEC	3	0	0	3	3
5.	CMG353	Operation And Supply Chain Analytics	PEC	3	0	0	3	3
6.	CMG354	Financial Analytics	PEC	3	0	0	3	3

VERTICAL 5: ENVIRONMENT AND SUSTAINABILITY

SL. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	CES331	Sustainable infrastructure Development	PEC	3	0	0	3	3
2.	CES332	Sustainable Agriculture and Environmental Management	PEC	3	0	0	3	3
3.	CES333	Sustainable Bio Materials	PEC	3	0	0	3	3
4.	CES334	Materials for Energy Sustainability	PEC	3	0	0	3	3
5.	CES335	Green Technology	PEC	3	0	0	3	3
6.	CES336	Environmental Quality Monitoring and Analysis	PEC	3	0	0	3	3
7.	CES337	Integrated Energy Planning for Sustainable Development	PEC	3	0	0	3	3
8.	CES338	Energy Efficiency for Sustainable Development	PEC	3	0	0	3	3





MA3357

PROBABILITY AND STATISTICAL METHODS

L T P C

3 1 0 4

OBJECTIVE:

- To develop Probability techniques in manufacturing and quality evaluation process.
- To familiarize the students with two dimensional random variables.
- To familiarize the student with Differential Equations.
- To make the students to understand various techniques of Correlation and Time series Analysis.
- To acquaint the student with mathematical tools needed in evaluating Statistical quality control and to apply in the textile manufacturing industry.

UNIT I PROBABILITY AND RANDOM VARIABLES 9+3

Probability – axioms of probability – Conditional probability – Baye's theorem – Discrete and continuous random variables – Moments – Moment Generating functions – Binomial , Poisson , Geometric , Uniform , Exponential , Gamma and Normal distributions.

UNIT II TWO DIMENSIONAL RANDOM VARIABLES 9+3

Join distributions – Marginal distributions and conditional distributions – Moments – Covariance – Transforms of random variables – Central limit theorem.

UNIT III DIFFERENTIAL EQUATIONS 9+3

Higher order linear differential equations with constant coefficients – Method of variation of parameters – Homogenous equation of Euler's and Legendre's type – System of simultaneous linear differential equations with constant coefficients – Method of undermined coefficients.

UNIT IV CORRELATION, REGRESSION, INDEX NUMBERS AND TIMES SERIES ANALYSIS 9+3

Correlation analysis, estimation of regression line. Time series analysis: Variations in time series , trend analysis , cyclical variations , seasonal variations and irregular variations. Index Numbers – Lasperyre's, Paasche's and Fisher's Ideal Index.

UNIT V STATISTICAL QUALITY CONTROL 9+3

Control charts for measurements (X and R chart) – Control charts for attributes (p ,C and np) charts – Tolerance limits – acceptance Sampling.

TOTAL: 60 PERIODS**.OUTCOMES:**

At the end of the course the students will be able to

CO1: Use the Probability techniques for solving practical problems.

CO2: Apply two dimensional random variable tools in solving various problems.

CO3: Able to solve differential Equations by applying various techniques.

CO4: Apply different methods of Correlation, Regression, Index Numbers and Times series Analysis in solving practical problems.

CO5: Apply statistical techniques in solving manufacturing and management related problems

TEXT BOOKS:

1. Johnson, R.A., Miller, I and Freund J., "Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 8th Edition, 2015.
2. Milton. J. S. and Arnold. J.C., "Introduction to Probability and Statistics", Tata McGraw Hill, 4th Edition, 2007.
3. Kreyszig.E, "Advanced Engineering Mathematics", John Wiley and Sons, 10 th Edition, New Delhi, 2016.

- Grewal.B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 44 th Edition , 2018.
- Richard I. Levin, David S. Rubin, Sanjay Rastogi Masood Husain Siddiqui, Statistics for Management, Pearson Education, 7th Edition, 2016.

REFERENCES:

- Devore. J.L., "Probability and Statistics for Engineering and the Sciences", Cengage Learning, New Delhi, 8th Edition, 2014.
- Papoulis, A. and Unnikrishnappillai, S., "Probability, Random Variables and Stochastic Processes", McGraw Hill Education India, 4th Edition, New Delhi, 2010.
- Jain . R.K. and Iyengar. S.R.K., " Advanced Engineering Mathematics ", Narosa Publications, New Delhi, 5 th Edition, 2016.
- Ramana. B.V., " Higher Engineering Mathematics ", McGraw Hill Education Pvt. Ltd, New Delhi, 2016.
- Prem.S.Mann, "Introductory Statistics" 7th Edition, Wiley India, 2016.
- Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani, "An Introduction to Statistical Learning with Applications in R", Springer, 2016.
- Aczel A.D. and Sounderpandian J., "Complete Business Statistics", 6th edition, Tata McGraw Hill Publishing Company Ltd., New Delhi, 2012.

TC3301

POLYMER AND ORGANIC CHEMISTRY**L T P C
3 0 0 3****OBJECTIVE:**

- To describe individual operation used in pre-treatment and physical – chemical changes brought int to textile material.
- To explain chemical formulations and process parameters used in unit operations of pre-treatment and properties of chemicals used.
- To explain machinery used in pre-treatments operations.
- To discuss quality parameters and environmental impact of pre-treatment operations.
- To facilitate the students to learn about the pre-treatments of various kinds of textile materials involved in textile wet processing industries.

UNIT I POLYMERIZATION**9**

Polymers – Classifications – Polymerization – Mechanisms – Chain Polymerization (Free radical, ionic and Ziegler Natta). Polymerization Techniques – Bulk, Solution, Suspension, Emulsion, Solid and Liquid Phase. Poly condensation Techniques – Melt, Solution and Interfacial.

UNIT II IMPORTANT POLYMERS**9**

Synthesis, properties and Applications : Polyethylene (LDPE & HDPE), Polyacrylonitrile, Polymethyl methacrylate, Polyesters (PET), Polyamides – Nylon 6, Nylon 6,6 , Polyurethane, Polyvinylchloride, Polypropylene, Polytetrafluoroethylene.

UNIT III CHARACTERIZATION OF POLYMERS**9**

Degree of Polymerization – Glass Transition Temperature – Factors affecting T_g - Determination of T_g – Dilatometer and Thermo mechanical methods. Determination molecular weights – Weight average – Light scattering, Number average – End group analysis, Viscosity average –

Ubbelohde viscometer. Thermal characterization – TGA and DSC.

UNIT IV AROMATIC HYDROCARBON, AMINE AND DIAZONIUM SALT 9

Benzene – Aromaticity – Huckel rule – General methods of preparation of benzene – Electrophilic substitution reactions – Directive effects of substituents – Aromatic amino compounds – General methods of preparation – Physical and chemical properties – Carbylamines reaction – Aryldiazonium salts – Preparation and synthetic applications.

UNIT V ALDEHYDES, KETONES AND ACIDS 9

General methods of preparation – Physical and chemical properties – Aldol condensation – Clemmensen reduction – Wolf-Kishner reduction – Haloform reaction – Cannizzaro reaction – Reformatsky reaction – Wittig reaction – Saturated monocarboxylic acids – Methods of preparation – Physical and chemical properties – Hell-Volhard-Zelinsky reaction – Amino acids – Methods of preparation – Physical and chemical properties.

TOTAL: 45 PERIODS.

OUTCOMES:

At the end of the course the students will be able to understand

CO1: Polymerization.

CO2: Important Polymers.

CO3: Characterization Of Polymers.

CO4: Aromatic Hydrocarbon, Amine And Diazonium Salt.

CO5: Aldehydes, Ketones And Acids

TEXT BOOKS:

1. Paul.C, polymer chemistry, NCUTE Publications, Hiemenz , 2007
2. Shenai V.A.,Advanced Organic Chemistry, Sevak Publications, Wadala, Chennai, 1991.

REFERENCES:

1. Nalankilli.G, Edwin Sundar.A, Chemical Preparatory Processes for Textiles, NCUTE Publications, New Delhi, 2002
2. Karmakar, S.R., Chemical Technology in the Pre-Treatment Processes of Textiles. Elsevier Science, 1999
3. Chakraborty, J.N, Fundamentals and Practices in colouration of textiles, Woodhead Publishing India, 2009, ISBN – 13: 978-81-908001-4-3.
4. Bleaching & Mercerizing – BTRA Silver Jubilee Monograph series
5. Technology of Mercerizing by J.T. Marsh

CO's	PO's												PSO's			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
1	2	-	1	-	-	1	2	1	-	1	1	1	2	1	2	2
2	2	1	-	1	-	1	1	-	-	1	-	1	1	1	2	1
3	1	2	-	-	2	1	-	-	1	-	-	-	2	1	1	2
4	1	-	1	1	1	2	1	1	1	1	-	1	3	2	2	2
5	1	-	1	1	1	2	1	1	1	1	-	1	3	1	2	1
AVg	1.4	1.5	1	1	1.3	1.4	1.2	1	1	1	0.5	1	2.2	1.2	1.8	1.6

TC3302

PREPARATION OF TEXTILES FOR COLORATION

L T P C
3 0 0 3**OBJECTIVE:**

- To describe individual operation used in pre-treatment and physical – chemical changes brought int to textile material.
- To explain chemical formulations and process parameters used in unit operations of pre-treatment and properties of chemicals used.
- To explain machinery used in pre-treatments operations.
- To discuss quality parameters and environmental impact of pre-treatment operations.
- To facilitate the students to learn about the pre-treatments of various kinds of textile materials involved in textile wet processing industries.

UNIT I SINGEING & DESIZING**9**

Impurities present in different fibres, Inspection of grey goods and lot preparation. Shearing and Cropping Singeing of cotton and blended fabrics. Yarn singeing – Singeing of tubular knitted fabrics. Tightrope, Slack rope washing. Acid desizing and its limitations, enzyme desizing – Typical recipe for desizing of different materials – different desizing methods. Open width washing machine. Degumming of silks using soap, soap and soda ash, acids, amines and enzymes.

UNIT II SCOURING**9**

Principles of Scouring: jumbo/JT-10, Vapourlac and soft flow machine, Chemical and auxiliaries for Scouring – Scouring of coloured goods – Degumming of Silk, Scouring of wool, silk P/C, P/V blends – Scouring of Jute, Souring of synthetic textiles, Solvent Scouring, Bio Scouring. Auxiliaries required for scouring of different materials and with respect to different materials.

UNIT III BLEACHING**9**

Principles of Bleaching: Importance of whiteness and whiteness retention – Bleaching mechanism of Hydrogen Peroxide, Hypo chlorites and Sodium chlorite – Parameters involved in bleaching action – Merits and Demerits of each bleaching agent – bleaching in rope form bleaching in Kier, Jumbo Jigger – Continuous \scouring and Bleaching of cotton goods in open width and rope form using H₂O₂ – Yarn Scouring and Bleaching using Cabinet hank dyeing machine. Bleaching of p/c blend in open width form by Pad roll and continuous methods using Hydrogen Peroxide and Sodium chlorite, bleaching of Jute – Knitted fabric bleaching on winches, soft flow – The concept of full bleaching –Mechanism of Whitening effect. Blueing agents and its use. Combined Bleaching & whitening. Typical recipe for bleaching of different fibres.

9**UNIT IV MERCERISATION**

Mercerizing – conditions. Physical and Chemical changes – Mercerizing of coloured goods P/C blends and tubular knits. Effects of Time, Tension, Caustic Concentration, Temp on mercerizing effects. Stack mercerizing, Hot mercerizing, mercerizing of blending fabrics.

9**UNITV DEVELOPMENTS**

Developments in grey preparation – combined processing enzymatic scouring & bleaching, cold bleaching; prograde process (liquid ammonia mercerization) Developments in desizing, Scouring, Bleaching and mercerizing, plasma based preparation, ozone bleaching. Milling, Grabbing and potting

TOTAL: 45 PERIODS**OUTCOMES:**

- CO1: Illustrate individual operation used in pre-treatment and physical – chemical changes brought in to textile material.
- CO2: Demonstrate chemical formulations and process parameters used in unit operations of pre-treatment and properties of chemicals used.
- CO3: Explain machinery used in pre-treatments operations.
- CO4: Explain quality parameters and environmental impact of pre-treatment operations.
- CO5: Design wet processing techniques such as singeing, desizing, mercerizing, scouring and bleaching of different textile materials at desired levels.

TEXT BOOKS:

1. Trotman, E.R., Textile Scouring and Bleaching, Charless Griffins, Com. Ltd., London 1990.
2. Shenai V.A., Technology of Bleaching and Mercerizing, Sevak Publications, Wadala, Chennai, 1991.

REFERENCES:

1. Nalankilli.G, Edwin Sundar.A, Chemical Preparatory Processes for Textiles, NCUTE Publications, New Delhi, 2002
2. Karmakar, S.R., Chemical Technology in the Pre-Treatment Processes of Textiles. Elsevier Science, 1999
3. Chakraborty, J.N, Fundamentals and Practices in colouration of textiles, Woodhead Publishing India, 2009, ISBN – 13: 978-81-908001-4-3.
4. Bleaching & Mercerizing – BTRA Silver Jubilee Monograph series
5. Technology of Mercerizing by J.T. Marsh

CO's	PO's												PSO's			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
1	2	-	1	1	-	2	2	2	-	1	-	2	2	2	2	1
2	2	-	2	2	1	2	3	1	2	2	1	1	2	1	2	1
3	1	-	2	-	2	1	1	-	-	2	-	2	1	1	3	2
4	1	-	1	3	1	2	3	2	2	1	-	1	2	1	2	1
5	2	2	3	-	1	-	2	2	-	-	-	2	3	2	1	2
Avg	1.5	2	1.8	2	1.2	1.7	2.2	1.7	2	1.5	0.5	1.6	2	1.4	2	1.4

TEXT BOOKS:

1. Morton W. E. and Hearle J. W. S., "Physical Properties of Textile Fibres", The Textile Institute, Washington D.C., 2008.
2. Meredith R. and Hearle J. W. S., "Physical Methods of Investigation of Textiles", Wiley Publication, New York, 1989
3. Mukhopadhyay S. K., "Advances in Fibre Science", The Textile Institute, 1992

REFERENCES:

1. Meredith R., "Mechanical Properties of Textile Fibres", North Holland, Amsterdam, 1986.
2. Hearle J. W. S. Lomas B. and Cooke W. D., "Atlas of Fibre Fracture and Damage to Textiles", The Textile Institute, 2nd Edition, 1998.
3. Raheel M. (ed.), "Modern Textile Characterization Methods", Marcel Dekker, 1995.
4. Mukhopadhyay S. K., "The Structure and Properties of Typical Melt Spun Fibres" Textile Progress

CO's	PO's												PSO's			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
1	2	-	1	2	1	-	-	-	1	2	-	2	2	1	1	2
2	1	2	-	2	1	-	1	-	-	1	-	1	2	2	1	1
3	2	2	-	1	-	2	1	1	-	2	1	2	1	1	2	1
4	2	-	1	2	1	-	-	-	1	2	-	2	2	1	1	1
5	1	2	-	2	2	-	1	-	-	1	-	1	2	1	2	2
AVg	1.6	2	1	1.8	1	2	1.5	0.5	1	1.6	0.5	1.6	1.8	1.2	1.4	1.4

PROGRESS THROUGH KNOWLEDGE

TC3304 TECHNOLOGY OF YARN AND FABRIC MANUFACTURING

**L T P C
3 0 0 3**

OBJECTIVE:

- To enable the students to understand various processes involved in conversion of fibre to yarn by ring spinning system and other modern spinning systems.
- To teach weaving and non-woven technologies of fabric manufacturing and the machinery used.

UNIT I GINNING, BLOW ROOM, CARDING AND DRAWING**9**

Ginning – objectives, types, working principle and ginning performance on yarn quality; opening and cleaning – objectives of blow room machines, principle of opening, cleaning and blending machines, principles of carding, working of carding machine; drawing machine– objectives, drafting system – types and applications, principles of auto levelers

UNIT II COMBER, ROVING**9**

Comber preparation – objectives, principles of sliver lap ribbon lap and super lap formers; comber - principle of combing, sequence of combing operation; Roving machine – objectives, working principle and operation

UNIT III SPINNING**9**

Ring spinning machine – objectives, working principle and operation; Principles of yarn formation and material flow – rotor, friction, air-jet and air vortex spinning

UNIT IV WINDING, SIZING**9**

Purpose and types of cone winding machines- Yarn clearers -Mechanical, Electrical Pirn winding machine – Types – yarn faults. Warping & Sectional warping machines. Sizing – size ingredients.

UNIT V WEAVING**9**

Basic Principles of Tappet looms, Dobby looms, Drop box Looms, Jacquard looms. Basic concepts of Shuttle less looms – Rapier, projectile and Air jet looms. Salient features. Analysis of fabric defects.

TOTAL: 45 PERIODS**OUTCOMES:**

Upon completion of this course, the student shall be able to

CO1: Understand the Principle and operations of Ginning, Blow Room, Carding and Drawing.

CO2: Understand the Principle and operations of Comber preparation, comber, Roving.

CO3: Understand the Principle and operations of Ring spinning, rotor, friction, air-jet and air-vortex Spinning.

CO4: Understand the Principle and operations of cone winding, Pirn winding, Warping, Sizing.

CO5: Understand the Principle and operations of Tappet looms, Dobby looms, Drop box

Looms, Jacquard looms, Shuttle less looms.

TEXT BOOKS:

1. Klein W., "The Technology of Short-staple Spinning ", The Textile Institute, Manchester, 1998.
2. Talukdar M.K., Sriramulu P.K. and Ajsaonkar D.B., "Weaving: Machines, Mechanisms, Management
3. Oxtoby E., "Spun Yarn Technology ", Butterworth, London, 1987, ISBN: 0408014644 /ISBN- 13: 9780408014649.

REFERENCES:

1. Chattopadhyay R., Technology of Carding, NCUTE, IIT Delhi,2003.
2. Chattopadhyay R. & Rengasamy R., "Spinning, Drawing, Combing & Roving, NCUTE Pilot Programme.
3. Salhotra K. R. & Chattopadhyay R., Book of papers on "Blowroom and Carding", IIT Delhi1998.
4. Ormerod A., Modern Preparation and Weaving, Merrow Publication Co. U.K.1988.
5. Talukdar M.K., "An Introduction to Winding and Warping" Testing Trade Press, Mumbai.
6. Talavasek O. & Svaty V., Shuttleless Weaving Machines, Elsevier Scientific Pub. Co., New York1981.
7. Adanur S., Handbook of Weaving, Technomic Publishing Co., Inc.,2001.

Flame retardant, Soil release.

TOTAL: 45 PERIODS

OUTCOMES:

Upon completion of the course, the students will be able to know about role of auxiliaries in

CO1: Modification of surface tension

CO2: Preparatory Process

CO3: Dyeing Process

CO4: Printing Process

CO5: Finishing

TEXT BOOKS:

1. Shennai.V.A, "Organic Textile Chemicals", Sevak Publication, Bombay,1995
2. Vaidya.A.A, "Chemistry of Textile auxiliaries", Wheeler Publishing, NewDelhi,1999

REFERENCES:

1. John Shore, "Colourants & Auxiliaries" Wiley and Sons Ltd, New York, Volume I & II,1999.
2. Chakraborty, J.N, "Fundamentals and Practices in colouration of Textiles", Woodhead Publishing India, 2009, ISBN-13:978-81-908001-4-3
3. Shennai.V.A, "Organic Textile Chemicals", Sevak Publication, Bombay,1995
4. Vaidya.A.A, "Chemistry of Textile auxiliaries", Wheeler Publishing, NewDelhi,1999
5. W D Schindler P J Hauser., "Chemical Finishing of Textiles", Woodhead publishing Ltd, 2004.
6. Mathews Kolanjikombil., "Dyeing of Textile substrates III –Fibres, Yarns and Knitted fabrics", Woodhead publishing India , 2021
7. Trotman E. R., "Dyeing and Chemical Technology of Textile Fibres", Charles Griffin & Co. Ltd., U.K., 1984, ISBN : 0 85264 165 6.
8. Dr. N N Mahapatra., "Textile dyeing", Woodhead publishing India, 2018

CO's	PO's												PSO's			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
1	2	2	1	-	1	2	3	2	1	2	1	3	2	1	2	3
2	2	1	2	1	2	1	2	1	-	1	1	1	1	2	1	2
3	3	2	1	-	2	3	1	2	2	1	-	2	2	1	1	2
4	2	2	1	1	1	2	1	1	1	-	1	2	3	2	1	2
5	3	2	1	1	1	2	1	2	-	1	1	2	1	1	2	1
AVg	2.4	1.8	1.2	1	1.4	2	1.6	1.6	1.3	1.2	1	2	1.8	1.4	1.4	2

TC3311

YARN AND FABRIC MANUFACTURING LABORATORY

L T P C
0 0 3 1.5**OBJECTIVE:**

To enable the students to

- Make the students identify a problem/process relevant to their field of interest that can be carried out
- Make them equipped to search databases and journals to collect relevant data and identify a solution
- Plan, learn and perform experiments to verify the solution

LIST OF EXPERIENTS

1. Material passage and production calculation in
 - a. Blow room scutcher
 - b. Carding machine
 - c. Comber
 - d. Draw frame
 - e. Speed frame
2. Material passage, draft, twist and production calculation in ring frame
3. Material passage and production calculation in winding machine
4. Timing diagram of weaving machine
5. Shedding mechanisms - Tappet, dobby
6. Jacquard mechanism
7. Picking mechanism and calculation of shuttle speed
8. Beat-up mechanism
9. Let-off and take-up mechanism
10. Auxiliary mechanisms

TOTAL: 45 PERIODS**OUTCOMES:**

Upon completion of this practical course, the students shall be able to

CO1 : Understand the material passage in the machine

CO2 : Draw gearing diagram

CO3 : Identify the components of spinning and weaving machines

CO4 : Calculate draft, twist and production rate of spinning machines

CO5 : Understand the mechanism of weaving machine

LAB EQUIPMENTS**LIST OF EQUIPMENT FOR BATCH OF 30 STUDENTS**

- | | |
|----------------------------------|---------|
| 1. Blow room Line | – 1 No. |
| 2. Carding machine | – 1 No. |
| 3. Drawing machine | – 1 No. |
| 4. combing machines | – 1 No. |
| 5. Roving machine | – 1 No. |
| 6. Ring Frame | – 1 No. |
| 7. Cone / Cheese winding machine | – 1 No. |
| 8. Pirm winding machine | – 1 No. |
| 9. Loom with tappet shedding | – 1 No. |
| 10. Loom with dobby shedding | – 1 No. |
| 11. Loom with jacquard | – 1 No. |

12. Loom with drop box

– 1 No.

CO's	PO's												PSO's			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
1	2	1	2	2	1	1	3	1	2	2	1	2	2	1	2	2
2	3	2	1	1	-	2	1	-	2	1	2	2	2	1	1	2
3	2	1	2	2	1	2	1	2	1	1	1	3	3	2	1	3
4	3	2	1	2	2	1	2	1	3	2	1	2	2	1	2	2
5	2	2	1	1	2	2	1	1	2	2	1	2	3	1	2	2
AVg	2.4	1.6	1.4	1.6	1.5	1.6	1.6	1.2	2	1.6	1.2	2.2	2.4	1.2	1.6	2.2

TC3312

FIBRE SCIENCE LABORATORY

LTPC
0021**OBJECTIVE:**

To enable the students to understand the

- Identification of fibres by different methods
- Method of characterization of fibres

LIST OF EXPERIENTS

1. Identification of natural, regenerated and synthetic fibres
2. Preparation of density gradient column and determination of density of various fibres
3. Determination of denier of synthetic fibres
4. Determination of moisture regain and moisture content of fibres
5. Determination of wax content and spin finish of natural and synthetic fibres
6. Identification of fibres and determination of the blend proportion of
 - a. Cotton/ regenerated cellulose
 - b. Polyester/ protein fibres
 - c. Cellulose/polyester fibres
 - d. Cotton/ viscose/polyester
7. Viscosity and molecular weight determination
8. Analysis of Thermograms of fibers
9. Analysis of FTIR spectrograms of fibers
10. Coagulation of polymers in wet spinning
 - a. Viscose
 - b. Acrylic
11. Analysis of XRD patterns of various fibre

TOTAL: 30 PERIODS**OUTCOMES:**

Upon completion of this practical course, the students shall be able to

- CO1: Identify the fibres using solubility test
 CO2: Identify the fibres using burning test
 CO3: Identify the fibres using microscopic characterization
 CO4: Determination of linear density, density and moisture properties of fibres
 CO5: Analyze the results of TGA, FTIR spectrometer and X-ray diffractometer

LAB EQUIPMENTS

LIST OF EQUIPMENT FOR BATCH OF 30 STUDENTS

- | | |
|-------------------------|---------|
| 1. Microscope | - 1 No. |
| 2. Weighing balance | - 1 No. |
| 3. Conditioning Chamber | - 1 No. |

CO's	PO's												PSO's			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
1	3	2	3	1	1	1	2	2	1	2	1	1	3	3	2	3
2	2	2	2	1	1	1	2	2	1	2	1	1	3	3	2	2
3	2	2	1	1	1	1	2	1	1	2	1	1	2	2	1	1
4	3	2	2	2	1	1	2	1	1	2	1	1	3	2	2	2
5	3	3	2	2	2	1	2	1	1	2	1	1	3	1	3	2
AVg	2.6	2.2	2	1.4	1.2	1	2	1.4	1	2	1	1	2.8	2.2	2	2



TC3401 CHEMISTRY AND TECHNOLOGY OF INTERMEDIATES AND DYES**L T P C
3 0 0 3****OBJECTIVE:**

- To enable the students to learn about the raw materials & purification of intermediates for dyes preparation
- To explain the students about the basic chemistry & mechanism in dye & dye intermediates preparation

UNIT I INTRODUCTION TO DYES 9

Coal tar – fractional distillation and their products. Aromatic hydrocarbons from petroleum. Introduction to primary and intermediate chemicals for dyes. Relation between Colour and Chemical Constitution. CI Name and Number.

UNIT II UNIT PROCESSES 9

Unit processes in organic synthesis such as halogenation, nitration, Sulphonation, esterification, alkylation, acetylation, hydroxylation, and diazotisation with suitable examples.

UNIT III AROMATIC INTERMEDIATES 9

Systematic study of important intermediates from benzene, chlorobenzene, toluene, nitrobenzene, aniline, phenol, salicylic acid, naphthalene and anthraquinone.

UNIT IV DYE INTERMEDIATES 9

Classification of dyes and intermediates. Introduction to azines, oxazines, thiazines, xanthine, acridine, Diphenyl and triphenyl methane dyes.

UNIT V DYES 9

Introduction to their chemistry and preparation of – Anthraquinone vat dyes, indigoid, solubilised vat dyes, reactive dyes, disperse dyes, Blueing and Fluorescent brightening agents.

TOTAL: 45 PERIODS**OUTCOMES:**

Upon completion of the course, the students will be able to

- CO:1 Understand about the Colour and Chemical Constitution
 CO:2 Understand about Unit processes in organic synthesis
 CO:3 Understand about Aromatic Intermediates
 CO:4 Understand about dyes and their intermediates
 CO: 5 Understand about chemistry and preparation of Dyes.

TEXT BOOKS:

1. Shenai, V.A., "Introduction to the Chemistry of Dyestuffs", Sevak Publications, Mumbai 1995
2. Shore, J. (Ed)., "Colorants and auxiliaries, Volume 1, :Colorants", SDC, Blackwells, Leeds, 1990,

REFERENCES:

1. Venkatraman.K., "The Chemistry of Synthetic Dyes" – Vol. I & II, Academic press, London, 1990
2. David.R.Waring, Geoffrey Hallas, The Chemisry and Application of Dyes, SDC,1990.
3. John Shore, "Colourants& Auxiliaries" Wiley and Sons Ltd, New York, Volume I & II,1999.

4. Chakraborty, J.N, "Fundamentals and Practices in colouration of Textiles", Woodhead Publishing India, 2009, ISBN-13:978-81-908001-4-3

CO's	PO's												PSO's			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
1	2	2	2	-	1	2	3	2	1	2	1	1	2	1	2	3
2	3	2	1	1	2	3	2	1	1	1	1	3	2	2	1	2
3	2	2	1	1	2	1	1	2	1	1	-	2	2	1	2	2
4	2	2	1	1	1	2	1	1	1	-	1	2	3	2	1	1
5	3	1	1	1	1	2	1	2	1	1	1	2	2	1	2	2
AVg	2.4	1.8	1.2	1	1.4	2	1.6	1.6	1	1.2	1	2	2.2	1.4	1.6	2

TT3591

TESTING OF TEXTILE MATERIALS**L T P C**
3 0 0 3**OBJECTIVES:**

- To make the students understand the principle and method of working of equipment's used for testing of textile materials

UNIT I SAMPLING AND FIBRE TESTING 9

Sampling: Sampling of fibres, yarns and fabrics. Standard test atmosphere, measurement of relative humidity. Moisture content and regain of textile materials: Measurement methods. Fibre Length Measurement; Fibre Fineness Measurement. Measurement of cotton fibre maturity, trash and micro dust. High Volume instruments, Advanced fibre information system. standards and norms

UNIT II YARN TESTING 9

Yarn testing - yarn numbering, twist in single and ply yarns, single yarn strength, lea strength, yarn mass evenness, yarn hairiness; yarn friction– static and dynamic; standards and norms

UNIT III TESTING OF FABRIC MECHANICAL PROPERTIES - 9

Fabric testing - tensile, tear, bursting strength, ballistic impact, Low stress mechanical properties - Kawabata Evaluation System; FAST; standards and norms

UNIT IV TESTING OF SERVICEABILITY 9

Test procedure - abrasion resistance, pilling resistance, stiffness, drape ability, crease recovery, wrinkle recovery, air permeability; standards and norms

UNIT V FABRIC INSPECTION AND GARMENT QUALITY 9

Fabric defects – inspection and grading, acceptable quality level; quality assessment of garments - cutting, sewing, pressing, finishing and packaging defects; standards

TOTAL: 45 PERIODS**OUTCOMES:**

Upon completion of this course, the student will be able to

CO1: Explain the importance and test procedure for various fibres and its properties

CO2: Discuss the testing of various yarn properties

CO3: Describe various test procedure for fabric mechanical and aesthetic related properties

CO4: Explain the test procedure for determining low stress mechanical properties of fabric

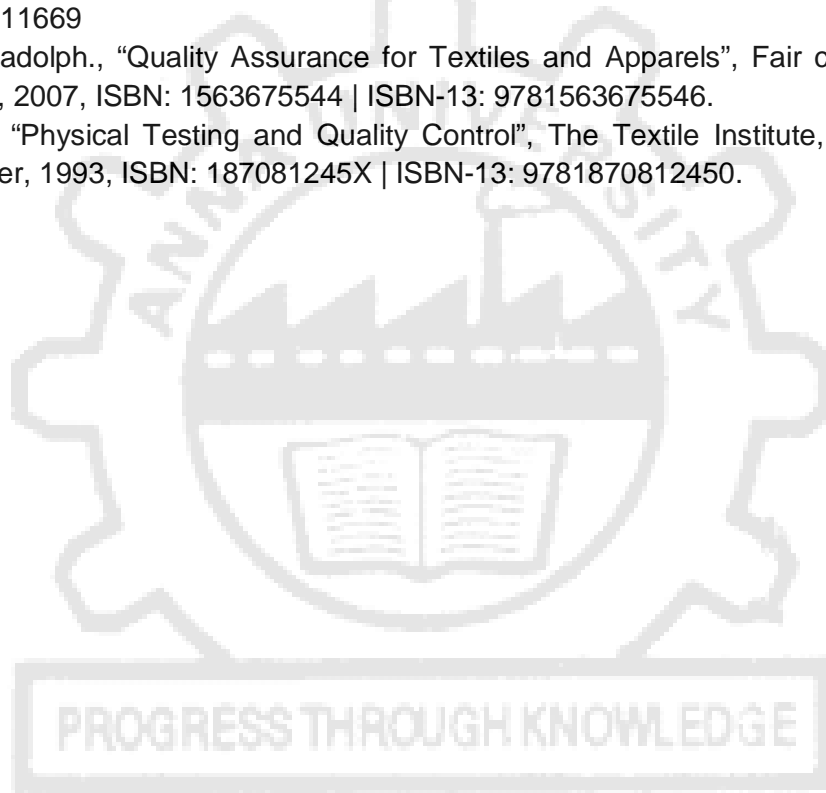
CO5: Discuss the fabric inspection and quality assessments of garment

TEXTBOOKS

1. Booth J.E., "Principle of Textile Testing", Butterworth Publications, London, 1989, ISBN: 0592063259 | ISBN-13: 9780592063256.
2. Kothari V. K., "Progress in Textiles: Science & Technology Vol 1 Testing & Quality Management", IAFL Publications, New Delhi, 1999, ISBN: 819010330X | ISBN-13: 9788190103305

REFERENCES

1. Seville B.P., "Physical Testing of Textiles", Textile Institute, Manchester, 1999, ISBN: 1855733676 | ISBN-13: 9781855733671.
2. Ruth E.Glock., and Grace I. Kunz., "Apparel Manufacturing – Sewn Product Analysis Fourth Edition", Pearson/Prentice Hall, 2005, ISBN: 0131119826 / ISBN: 978-0131119826
3. Pradip V. Mehta P.E., and Satish K. Bhardwaj., "Managing Quality in the Apparel Industry", National Institute of Fashion Technology, India 1998, ISBN: 8122411665 | ISBN-13: 9788122411669
4. Sara J. Kadolph., "Quality Assurance for Textiles and Apparels", Fair child Publications, New York, 2007, ISBN: 1563675544 | ISBN-13: 9781563675546.
5. Slater K., "Physical Testing and Quality Control", The Textile Institute, Vol.23, No.1/2/3 Manchester, 1993, ISBN: 187081245X | ISBN-13: 9781870812450.



Course Articulation Matrix:

Course Outcomes	Statement	Program Outcome														
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	Explain the importance and test procedure for various fibres and its properties	3	3	2	3	2	-	-	-	-	-	-	1	3	1	2
CO2	Discuss the testing of various yarn properties	3	3	2	3	2	-	-	-	-	-	-	1	3	1	2
CO3	Describe various test procedure for fabric mechanical and aesthetic related properties	3	3	2	3	2	-	-	-	-	-	-	1	3	1	2
CO4	Explain the test procedure for determining low stress mechanical properties of fabric	3	3	2	3	2	-	-	-	-	-	-	1	3	1	2
CO5	Discuss the fabric inspection and quality assessments of garment	3	3	2	3	2	-	-	2	-	-	-	1	3	1	2
Overall CO		3	3	2	3	2	-	-	2	-	-	-	1	3	1	2

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively

PROGRESS THROUGH KNOWLEDGE

TC3402

PRINCIPLES AND THEORY OF DYEINGL T P C
3 0 0 3**OBJECTIVE:**

- To expose the students about the mechanics of dyeing
- To enable the students to learn about colour, combinations of colours, their source and measurement
- To expose the students to the factors influencing the dyeing

UNIT I CHEMICAL KINETICS 9

Kinetics, characteristics of second order reaction – concept of activation energy – Arrhenius equation – Theory of absolute reaction rates – Kinetics of Enzyme Catalyzed reactions. Kinetic of dyeing. Factors affecting the kinetics of dyeing.

UNIT II ADSORPTION AND CATALYSIS 9

Physical and Chemical adsorption – Important isotherms – Freundlich and Langmuir adsorption isotherms. Homogeneous catalysis – Heterogeneous catalysis, acid – base catalysis, Enzyme catalysis – Applications of catalysis in industries.

UNIT III ELECTROCHEMISTRY 9

Electrical Conductance – Specific conductance – Equivalent conductance – variation with dilution - Kohlrausch's law – Galvanic cells –Reference electrode– Standard Hydrogen electrode – Nernst equation Electrochemical series – Applications of EMF measurements.

UNIT IV FIBER PROPERTIES AND ITS EFFECT ON DYEING 9

Influence of Fibre structure, – Dyeing behaviour of drawn, heat set and texturizing of textile materials. Interpretation between dye molecules and fibre polymeric chains –Substantivity and affinity of dyes with textile materials.

UNIT V FACTORS INFLUENCING DYEING 9

Glass transition temperature and its effect on dye stability and dye diffusion temperature. Diffusion of dyes – Fick's first and second law of diffusion. Derivation of William Landed Ferry (WLF) equation and its significances on textile dyeing.

TOTAL: 45 PERIODS**OUTCOMES:**

Upon completion of the course, the students will be able to

- CO1: Understand the Chemical Kinetics
- CO2: Understand the Adsorption And Catalysis
- CO3: Understand the Electrochemistry
- CO4: Understand the Fiber Properties And Its Effect On Dyeing

CO5: Understand the Factors Influencing Dyeing

TEXT BOOKS:

1. Puri B.H. and Sharma L.R. Principles of Physical Chemistry, S. Nagin Chand and Company, Delhi, 1994
2. Gordon M. Barrow, Physical Chemistry, Sixth edition, Tata McGraw-Hill, 1998

REFERENCES:

1. Peters.A.T and Freeman,H.S "Physico – Chemical Principles of Colour Chemistry", Blackie, ISBN:0751402109.1995
2. Johnson A, "The Theory of Colouration of Textiles", SDC 2nd Edition,1998.

CO's	PO's												PSO's			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
1	2	2	1	2	1	2	2	1	2	2	1	2	2	2	3	2
2	3	2	2	1	2	2	2	2	1	1	1	2	3	1	2	2
3	3	3	2	2	1	1	2	3	2	2	2	3	2	2	3	2
4	2	2	1	2	2	1	2	2	3	2	1	2	3	1	2	3
5	3	2	2	1	1	2	1	1	2	1	1	2	2	2	2	3
AVg	2.6	2.2	1.6	1.6	1.4	1.6	1.8	1.8	2	1.6	1.2	2.2	2.4	1.6	2.4	2.4

TC3403 DYEING OF CELLULOSIC AND PROTEIN MATERIALS**L T P C
3 0 0 3****OBJECTIVE:**

- To provide the knowledge on theory of dyeing fibrous material
- To provide the knowledge on classification, principle, shop floor practice & problems in the application of various dyes on textiles
- To enable the students to understand machinery used for dyeing of textile materials through class room discussion and field visits.

UNIT I INTRODUCTION**9**

Basic concept of dye and pigment, Definition of affinity, substantivity, reactivity, exhaustion, depth of dyeing, percentage shade. Concepts of exhaust and padding techniques of dyeing. Basic mechanisms of dyeing techniques such as mechanical deposition, chemical fixation. Classification of dyes according to methods of application. Influence of pretreatment on dyeing properties.

UNIT II DIRECT AND REACTIVE DYES**9**

Direct dyes: General properties, principles and method of application on cellulosic materials. Classification dyeing of cellulosic materials. Various after treatments to improve the wash fastness and light fastness. Practical problems and their remedies. Reactive dyes – Chemistry, concept of hot brand, cold brand, HE and vinyl sulphone reactive dyes, bifunctional and low salt reactive dyes, principle steps involved in dyeing of cellulosic materials. Practical problems remedy

UNIT III VAT DYES, OXIDATION COLOURS AND PIGMENTS**9**

Vat dyes: Chemistry and general properties classification. Principle steps involved in dyeing. Various methods of application of on cellulosic yarn and fabric with vat dyes. Stripping practical problems – dyeing and remedies. Solubilised vat dyes: Chemistry and general properties – Principles steps involved in dyeing of cellulosic materials. Dyeing of oxidation colours and

pigments

UNIT IV ACID DYES

9

Acid Dyes: Types based on application – Properties - Effect of electrolyte, temperature, time, pH and other dye bath assistants on dyeing of protein fibres. Mechanism of dyeing protein fibres. Application procedure for dyeing of wool, silk, stripping and re-dyeing.

UNIT V BASIC AND METAL COMPLEX DYES

9

Basic Dyes: Dyeing mechanism with protein fibres – application procedure of silk and wool mechanism of dyeing silk and wool with metal complex dyes – properties of chrome dyes – application procedure – chrome mordant, meta chrome and after chrome methods. Dyeing of wool with solubilised vat dyes.

TOTAL: 45 PERIODS

OUTCOMES:

Upon completion of the course, the students will be able to

CO1: Understand the theory of dyeing

CO2: Understand the dyeing of cellulosic textiles with Direct and reactive dyes

CO3: Understand the dyeing of cellulosic textiles with vat dyes, oxidation colours and Pigments

CO4: Understand the dyeing of synthetic textiles with Acid dyes

CO5: Understand the dyeing of synthetic textiles with Basic and Metal complex dyes

TEXT BOOKS:

1. Shenai V.A. "Technology of Dyeing" 1995, Sevak Publications, Mumbai.
2. Shore,J. "Blend Dyeing", SDC, London, 1998 ISBN: 0901956740.

REFERENCES:

1. Madaras, G.W., Parish, G.J., and Shore,J, "Batchwise dyeing of woven cellulosic fabrics", SDC, London, 1993, ISBN: 0901956554.
2. Shore,J. "Cellulosic Dyeing", SDC Publication, London, 1995 ISBN:0901956686.
3. Chakraborty, J.N, "Fundamentals and Practices in colouration of Textiles", Woodhead Publishing India, 2009, ISBN-13:978-81-908001-4-3.

CO's	PO's												PSO's			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
1	2	2	1	2	2	1	2	1	1	1	2	2	3	2	1	2
2	3	2	2	2	2	1	1	2	1	2	1	2	2	3	1	2
3	2	3	1	2	1	2	2	1	1	2	2	3	3	2	2	2
4	3	2	1	1	2	2	1	2	1	1	2	2	2	2	1	3
5	3	2	2	2	1	1	2	2	2	2	1	2	3	2	1	2
AVg	2.6	2.2	1.4	1.8	1.6	1.4	1.6	1.6	1.2	1.6	1.6	2.2	2.6	2.2	1.2	2.2

TC3404

TECHNOLOGY OF PRINTING

L T P C

3 0 0 3

OBJECTIVE:

- To enable the students to understand the fundamental concepts of printing of various kinds of fabrics using different colourants

UNIT I CONCEPTS OF PRINTING**9**

Definition of printing – Difference between printing and dying – Pretreatment and Fabric requirements for printing – Design details of printing like repeat of design, squeegees, bolting cloth, Preparation of Screen – Table and Rotary machine – Ingredients in printing with functions and their concentration of usage.

UNIT II THICKENERS**9**

Classification thickeners – Requirements to be a good thickener – Brief study on thickeners like CMC, Sodium Alginate, Indalca, Guar gum and Kerosene emulsion paste – Synthetics thickeners. Printing with Pigments, Classification of pigments, Synthetic binders, Catalyst, Cross Linking agents. Selection criteria for binders.

UNIT III DIRECT STYLE**9**

Printing with reactive dyes by steaming method, curing and silicate padding method – Advantages and Disadvantages of above methods– Printing with Rapid fast and Rapidogen colours, Printing with solubilised Vat dyes. IKAT Printing

UNIT IV DISCHARGE, RESIST STYLES**9**

Colour and White Discharge of cotton and viscose dyed materials – Problems associated with Discharge style printing. Brief study on Discharging agents and their usage and limitations of usage, Different styles of Resist printing of cellulose materials.

UNIT V PRINTING MACHINERY**9**

Roller printing machinery. Screen printing: flat bed screen - Rotary screen. Thermo transfer printing machinery. Garment printing machines. Printing paste formulations, printing of silk and woolen materials.

TOTAL: 45 PERIODS**OUTCOMES:**

Upon completion of the course, the students will be able to

- CO:1 Understand the concepts of printing of fabrics
- CO:2 Understand about thickeners
- CO:3 Understand the concepts of Direct Style of printing
- CO:4 Understand the concepts Discharge and Resist of printing.
- CO:5 Understand the Printing machinery and Printing of synthetic fabrics

TEXT BOOKS:

- Shenai V.A. "Technology of Textile Processing Vol. IV" 1998, Sevak Publications, Mumbai.
- Mills I.W.C. "Textile Printing" SDC Perkin House, 82, Grattom Rd, Yorkshire, England.1994, ISBN 0901956570.
- Storey, J. "Manual of Textile Printing", Thames & Hudson, 1992, ISBN: 0500680280.

REFERENCES:

- Kale D.G. "Principles of Cotton Printing edition – 2", Mahajan Books, Ahmedabad. 1979

2. Chakraborty, J.N, "Fundamentals and Practices in colouration of Textiles", Woodhead Publishing India, 2009, ISBN-13:978-81-908001-4-3.

CO's	PO's												PSO's			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
1	3	2	2	1	2	2	1	2	1	2	1	3	3	1	2	3
2	2	2	1	2	2	2	2	1	1	2	2	2	2	2	2	2
3	3	2	2	1	2	2	1	2	1	1	2	2	2	1	2	3
4	2	3	2	1	2	1	2	1	1	2	2	2	3	2	2	2
5	2	2	1	1	2	1	1	2	1	2	1	2	2	2	3	2
AVg	2.4	2.2	1.6	1.2	2	1.6	1.4	1.6	1	1.8	1.6	2.2	2.4	1.6	2.2	2.4

GE3451

ENVIRONMENTAL SCIENCES AND SUSTAINABILITY

L T P C
2 0 0 2**UNIT I ENVIRONMENT AND BIODIVERSITY****6**

Definition, scope and importance of environment – need for public awareness. Eco-system and Energy flow– ecological succession. Types of biodiversity: genetic, species and ecosystem diversity– values of biodiversity, India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ.

UNIT II ENVIRONMENTAL POLLUTION**6**

Causes, Effects and Preventive measures of Water, Soil, Air and Noise Pollutions. Solid, Hazardous and E-Waste management. Case studies on Occupational Health and Safety Management system (OHASMS). Environmental protection, Environmental protection acts .

UNIT III RENEWABLE SOURCES OF ENERGY**6**

Energy management and conservation, New Energy Sources: Need of new sources. Different types new energy sources. Applications of- Hydrogen energy, Ocean energy resources, Tidal energy conversion. Concept, origin and power plants of geothermal energy.

UNIT IV SUSTAINABILITY AND MANAGEMENT**6**

Development , GDP ,Sustainability- concept, needs and challenges-economic, social and aspects of sustainability-from unsustainability to sustainability-millennium development goals,and protocols-Sustainable Development Goals-targets, indicators and intervention areas Climate change- Global, Regional and local environmental issues and possible solutions-case studies.

Concept of Carbon Credit, Carbon Footprint. Environmental management in industry-A case study.

UNIT V SUSTAINABILITY PRACTICES 6

Zero waste and R concept, Circular economy, ISO 14000 Series, Material Life cycle assessment, Environmental Impact Assessment. Sustainable habitat: Green buildings, Green materials, Energy efficiency, Sustainable transports. Sustainable energy: Non-conventional Sources, Energy Cycles-carbon cycle, emission and sequestration, Green Engineering: Sustainable urbanization- Socio-economical and technological change.

TOTAL: 30 PERIODS

TEXT BOOKS:

1. Anubha Kaushik and C. P. Kaushik's "Perspectives in Environmental Studies", 6th Edition, New Age International Publishers ,2018.
2. Benny Joseph, 'Environmental Science and Engineering', Tata McGraw-Hill, New Delhi, 2016.
3. Gilbert M.Masters, 'Introduction to Environmental Engineering and Science', 2nd edition, Pearson Education, 2004.
4. Allen, D. T. and Shonnard, D. R., Sustainability Engineering: Concepts, Design and Case Studies, Prentice Hall.
5. Bradley. A.S; Adebayo, A.O., Maria, P. Engineering applications in sustainable design and development, Cengage learning.
6. Environment Impact Assessment Guidelines, Notification of Government of India, 2006.
7. Mackenthun, K.M., Basic Concepts in Environmental Management, Lewis Publication, London, 1998.

TT3581 TESTING OF TEXTILE MATERIALS LABORATORY

**L T P C
0 0 3 1.5**

OBJECTIVE:

- To make the students practically learn various fibre, yarn and fabric evaluation procedures to determine characteristics of fibres, yarn and fabric

LIST OF EXPERIMENTS

Determination of

1. Fibre fineness, length and maturity
2. Fibre trash content, Bundle fibre strength
3. Sliver/roving/ yarn linear density
4. Single yarn strength and Yarn Lea strength
5. Yarn single and ply yarn twist
6. Unevenness of yarn and assessment of yarn appearance
7. Fabric tensile strength,
8. Fabric tear and bursting strength
9. Fabric flexural rigidity, bending modulus and crease recovery
10. Drapeability of fabrics
11. Fabric abrasion and pilling resistance
12. Fabric air permeability
13. Fabric weight, thickness and dimensional stability
14. Seam strength and seam slippage

TOTAL: 45 PERIODS

OUTCOMES:

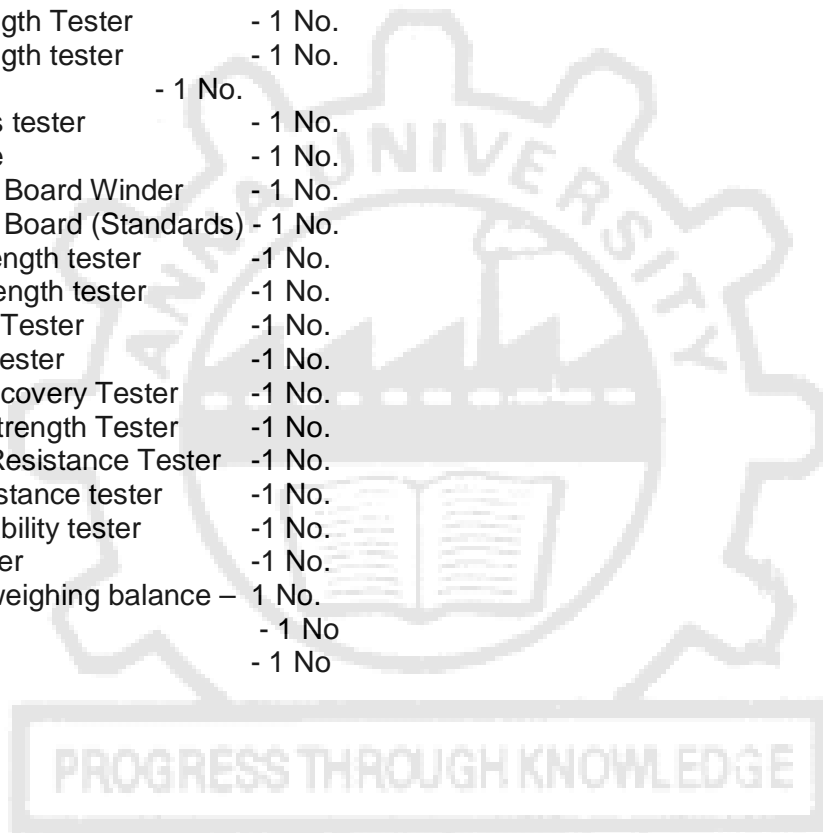
Upon the completion of this course the student will be able to

CO 1: Measure important characteristics of fibre and yarn
 CO2: Determine the important characteristics of fabrics
 CO3: Measure the seam strength and slippage of garment

LAB EQUIPMENTS

LIST OF EQUIPMENT FOR BATCH OF 30 STUDENTS

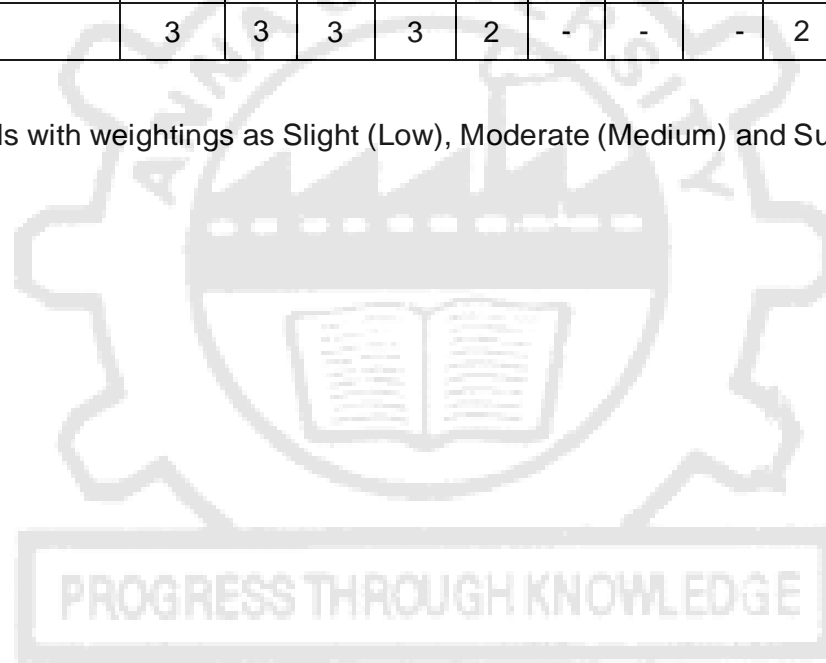
Baer Sorter	- 1 No.
Fibre Bundle strength tester	- 1 No.
Fibre Fineness tester	- 1 No.
Trash Analyzer	- 1 No.
Projection Microscope	- 1 No.
Wrap Reel	- 1 No.
Wrap Block	- 1 No.
Yarn Twist Tester	- 1 No.
Single Yarn Strength Tester	- 1 No.
Bundle yarn strength tester	- 1 No.
Ballistic Tester	- 1 No.
Yarn Unevenness tester	- 1 No.
Weighing balance	- 1 No.
Yarn appearance Board Winder	- 1 No.
Yarn appearance Board (Standards)	- 1 No.
Fabric tensile strength tester	-1 No.
Fabric tearing strength tester	-1 No.
Fabric Thickness Tester	-1 No.
Fabric Stiffness Tester	-1 No.
Fabric Crease Recovery Tester	-1 No.
Fabric Bursting Strength Tester	-1 No.
Fabric Abrasion Resistance Tester	-1 No.
Fabric Pilling resistance tester	-1 No.
Fabric air permeability tester	-1 No.
Fabric Drape meter	-1 No.
GSM cutter and weighing balance	- 1 No.
Lander-o-meter	- 1 No.
Crock meter	- 1 No.



Course Articulation Matrix:

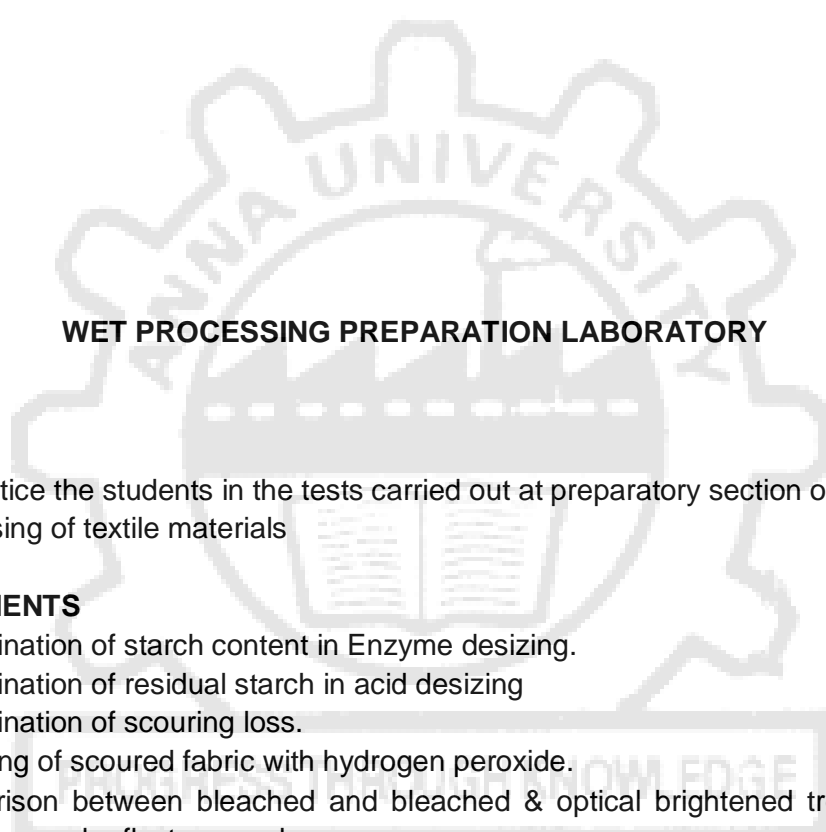
Course Outcomes	Statement	Program Outcome														
		PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO3
CO1	Measure important characteristics of fibre and yarn	3	3	3	3	2	-	-	-	2	2	2	1	3	2	3
CO2	Determine the important characteristics of fabrics	3	3	3	3	2	-	-	-	2	2	2	1	3	2	3
CO3	Measure the seam strength and slippage of garment	3	3	3	3	2	-	-	-	2	2	2	1	3	2	3
Overall CO		3	3	3	3	2	-	-	-	2	2	2	1	3	2	3

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively



REFERENCES:

1. R.K. Trivedi, 'Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards', Vol. I and II, Enviro Media. 38 .
2. Cunningham, W.P. Cooper, T.H. Gorhani, 'Environmental Encyclopedia', Jaico Publ., House, Mumbai, 2001.
3. Dharmendra S. Sengar, 'Environmental law', Prentice hall of India PVT. LTD, New Delhi, 2007.
4. Rajagopalan, R, 'Environmental Studies-From Crisis to Cure', Oxford University Press, 2005.
5. Erach Bharucha "Textbook of Environmental Studies for Undergraduate Courses" Orient Blackswan Pvt. Ltd. 2013.



TC3411

WET PROCESSING PREPARATION LABORATORY

**L T P C
0 0 3 1.5**

OBJECTIVE:

- To practice the students in the tests carried out at preparatory section of the wet processing of textile materials

LIST OF EXPERIENTS

1. Determination of starch content in Enzyme desizing.
2. Determination of residual starch in acid desizing
3. Determination of scouring loss.
4. Bleaching of scoured fabric with hydrogen peroxide.
5. Comparison between bleached and bleached & optical brightened treated sample for whiteness and reflectance value.
6. Determination of the yellowing of hypochlorite bleached (soured/not soured, but washed) fabrics.
7. Effect of time/ temperature in bleaching with hypochlorite (whiteness and strength loss).
8. Effect of pH/ available chlorine in bleaching with hypochlorite (whiteness and strength loss)
9. Scouring & Bleaching of knitted cotton fabrics in winch
10. Scouring & Bleaching of woven blend fabrics in jigger.
11. Bleaching of knitted fabrics in jigger.
12. Degumming of silk.
13. Scouring and Bleaching of wool using hydrogen peroxide.

TOTAL: 45 PERIODS

OUTCOMES:

Upon completion of this practical course, the students would be able to
CO1: Understand the Desizing process and Efficiency of fabric

- CO2: Understand the Scouring process and Efficiency of Scoured fabric
 CO3: Understand the Bleaching Process and Efficiency of Bleached fabric
 CO4: Understand the combined scouring and Bleaching
 CO5: Understand the scouring and Bleaching of synthetic fabrics

LAB EQUIPMENTS

LIST OF EQUIPMENT FOR BATCH OF 30 STUDENTS

1. Jigger – 1 No.
2. Winch – 1 No.
3. Water Bath – 1 No.
4. Tensile Strength Tester – 1 No.
5. Computer colour Matching system – 1 No.
6. PH Meter – 2 Nos.
7. Weighing balance – 1 No.

CO's	PO's												PSO's			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
1	2	2	3	2	1	2	1	2	2	2	2	1	3	2	2	2
2	2	2	3	2	1	2	1	2	2	2	2	1	3	2	2	1
3	2	2	3	2	1	2	2	2	2	2	2	1	3	2	2	2
4	2	1	2	1	1	1	1	2	1	2	2	1	3	2	2	1
5	2	2	2	1	1	1	1	2	1	2	2	1	3	2	2	2
AVg	2	1.8	2.6	1.6	1	1.6	1.2	2	1.6	2	2	1	3	2	2	1.6

PROGRESS THROUGH KNOWLEDGE

TC3412

TEXTILE CHEMICAL ANALYSIS LABORATORY

L T P C
0 0 3 1.5

OBJECTIVE:

- To practice the students in evaluation of chemicals and dyes used in textile wet processing industry

LIST OF EXPERIENTS

1. Estimation of the Efficiency of the wetting agent.
2. Estimation of strength of oxidizing agent.
3. Estimation of strength of reducing agent.
4. Estimation of strength of dispersing agent.
5. Estimation of strength of Optical Brightening agent.

6. Demonstration of UV-VIS spectrophotometer and instruments of working principles.
7. Evaluation of the inorganic substances in Textile processing.
8. Identification of dye powder.
9. Identification of the dye in the dyed fabric
10. Determination of Viscosity of liquid samples by using viscometer.
11. Evaluation of the finishing chemicals

TOTAL: 45 PERIODS

OUTCOMES:

Upon completion of this practical course, the students would be able to

CO1: Estimate different types of chemicals used for wet processing of textile materials.

CO2: Understand the UV-VIS spectrophotometer process

CO3: Evaluate the inorganic substances

CO4: Identify the dyes

CO5: Estimate purity of dye solution.

LAB EQUIPMENTS

LIST OF EQUIPMENT FOR BATCH OF 30 STUDENTS

1. Beaker Dyeing machine – 1 No.
2. Dye Bath – 1 No.
3. Weighing Balance – 1 No.
4. Stop Watch – 1 No.
5. Soxhlet Apparatus – 1 No.
6. Viscometer – 1 No.
7. UV-Vis spectrophotometer – 1 No.

CO's	PO's												PSO's			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
1	2	1	1	2	1	2	2	1	2	1	1	2	2	2	1	2
2	2	2	1	2	1	2	2	1	1	2	1	2	3	2	1	2
3	2	1	2	1	2	1	2	1	2	2	1	2	2	1	1	2
4	2	2	1	2	1	2	1	2	1	2	1	2	3	2	1	2
5	2	1	1	2	1	2	1	2	1	1	2	2	2	2	1	2
AVg	2	1.4	1.2	1.8	1.2	1.8	1.6	1.4	1.4	1.6	1.2	2	2.4	1.8	1	2