

**ANNA UNIVERSITY, CHENNAI**

**AFFILIATED INSTITUTIONS**

**R – 2013**

**B. TECH. TEXTILE CHEMISTRY**

**PROGRAMME OBJECTIVES:**

- Prepare the students to demonstrate technical competence in their profession by applying knowledge of basic and contemporary science, engineering and experimentation skills for identifying manufacturing problems and providing practical and innovative solutions.
- Prepare the students to understand the professional and ethical responsibilities in the local and global context and hence utilize their knowledge and skills for the benefit of the society.
- Enable the students to work successfully in a manufacturing environment and function well as a team member and also exhibit continuous improvement in their understanding of their technical specialization through self learning and the skill to apply it to further research and development.
- Enable the students to have sound education in selected subjects essential to develop their ability to initiate and conduct independent investigations.
- Develop comprehensive understanding in the area of textile chemistry through course work, practical training and independent study.

**PROGRAMME OUTCOMES:**

The students will be able to

- Apply knowledge of mathematics, science and engineering in textile chemical processing applications
- Design and conduct experiments, as well as to analyze and interpret data
- Design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
- Function on multidisciplinary teams
- Identify, formulate, and solve engineering problems related to textile chemical processing
- Understand the professional and ethical responsibility
- Prepare technical documents and present effectively
- Use the techniques, skills, and modern engineering tools necessary for practicing in the textile chemical processing industry.
- Build high moral character

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**B. TECH. TEXTILE CHEMISTRY**

**I - VIII SEMESTERS CURRICULUM AND SYLLABUS**

**SEMESTER – I**

<b>CODE</b>	<b>COURSE TITLE</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>THEORY</b>					
HS6151	Technical English - I	3	1	0	4
MA6151	Mathematics – I	3	1	0	4
PH6151	Engineering Physics – I	3	0	0	3
CY6151	Engineering Chemistry – I	3	0	0	3
GE6151	Computer Programming	3	0	0	3
GE6152	Engineering Graphics	2	0	3	4
<b>PRACTICAL</b>					
GE6161	Computer Practices Laboratory	0	0	3	2
GE6162	Engineering Practices Laboratory	0	0	3	2
GE6163	Physics and Chemistry Laboratory - I	0	0	2	1
	<b>TOTAL</b>	<b>17</b>	<b>2</b>	<b>11</b>	<b>26</b>

**SEMESTER – II**

<b>CODE</b>	<b>COURSE TITLE</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>THEORY</b>					
HS6251	Technical English - II	3	1	0	4
MA6251	Mathematics - II	3	1	0	4
PH6251	Engineering Physics - II	3	0	0	3
CY6251	Engineering Chemistry - II	3	0	0	3
GE6252	Basic Electrical and Electronics Engineering	4	0	0	4
GE6253	Engineering Mechanics	3	1	0	4
<b>PRACTICAL</b>					
GE6261	Computer Aided Drafting and Modeling Laboratory	0	1	2	2
GE6262	Physics and Chemistry Laboratory - II	0	0	2	1
GE6263	Computer Programming Laboratory	0	1	2	2
		<b>19</b>	<b>5</b>	<b>6</b>	<b>27</b>

### SEMESTER – III

CODE	COURSE TITLE	L	T	P	C
<b>THEORY</b>					
MA6468	Probability and Statistics	3	1	0	4
GE6351	Environmental science and Engineering	3	0	0	3
TC6303	Organic Chemistry	3	0	0	3
TT6302	Polymer Science	3	0	0	3
TC6301	Structure and Properties of Fibres	3	0	0	3
TC6302	Technology of Yarn Manufacture	3	1	0	4
<b>PRACTICALS</b>					
TC6311	Textile Chemicals Analysis Laboratory	0	0	3	2
TC6312	Fibre Analytical Laboratory	0	0	3	2
GE6674	Communication and Soft Skills- Laboratory Based	0	0	4	2
<b>TOTAL</b>		<b>18</b>	<b>2</b>	<b>10</b>	<b>26</b>

### SEMESTER – IV

CODE	COURSE TITLE	L	T	P	C
<b>THEORY</b>					
MA6459	Numerical Methods	3	1	0	4
TC6401	Chemistry and Technology of Intermediates and Dyes	3	0	0	3
TC6402	Preparation of Textiles for Coloration	3	0	0	3
TC6403	Principles & Theory of Dyeing	3	0	0	3
TC6404	Physical Testing of Textile Materials	3	0	0	3
TC6405	Technology of Fabric Manufacture	3	1	0	4
<b>PRACTICALS</b>					
TC6411	Wet Processing Preparation Laboratory	0	0	3	2
TC6412	Textile Physical Testing Laboratory	0	0	3	2
TC6413	Yarn and Fabric Manufacturing Laboratory	0	0	3	2
<b>TOTAL</b>		<b>18</b>	<b>2</b>	<b>9</b>	<b>26</b>

### SEMESTER – V

CODE	COURSE TITLE	L	T	P	C
<b>THEORY</b>					
TC6501	Chemistry of Textile Auxiliaries	3	0	0	3
TC6502	Wet Processing Machinery	3	0	0	3
TC6503	Dyeing of Textile Materials-I	3	0	0	3
TC6504	Technology of Printing- I	3	0	0	3
TC6505	Computer Colour Matching	3	0	0	3
TC6506	Dyeing of Synthetic Textiles	3	0	0	3
<b>PRACTICALS</b>					
TC6511	Dyeing of Synthetic Textile Laboratory	0	0	3	2
TC6512	Shade Matching and Quality Control Laboratory	0	0	3	2
TC6513	Textile Dyeing and Printing Laboratory- I	0	0	3	2
<b>TOTAL</b>		<b>18</b>	<b>0</b>	<b>9</b>	<b>24</b>

### SEMESTER – VI

CODE	COURSE TITLE	L	T	P	C
<b>THEORY</b>					
TC6601	Technology of Finishing	3	0	0	3
TC6602	Dyeing of Textile Materials-II	3	0	0	3
TC6603	Technology of Printing-II	3	0	0	3
TC6604	Instrumental Methods of Chemical Analysis	3	0	0	3
TC6605	Garment Manufacturing and Processing	3	0	0	3
	Elective I	3	0	0	3
<b>PRACTICALS</b>					
TC6611	Textile Finishing Laboratory	0	0	3	2
TC6612	Garment manufacturing and Processing Laboratory	0	0	3	2
TC6613	Textile Dyeing and Printing Laboratory- II	0	0	3	2
	<b>TOTAL</b>	<b>18</b>	<b>0</b>	<b>9</b>	<b>24</b>

### SEMESTER – VII

CODE	COURSE TITLE	L	T	P	C
<b>THEORY</b>					
TC6701	Water and Effluent Treatment and Pollution Control	3	0	0	3
TT6701	Total Quality Management for Textile Industry	3	0	0	3
TC6702	Process and Quality control in Textile Wet Processing	3	0	0	3
TT6702	Operation Research for Textile Industry	3	0	0	3
	Elective II	3	0	0	3
	Elective III	3	0	0	3
<b>PRACTICALS</b>					
TC6711	Product Development Laboratory	0	0	3	2
TC6712	Problem Analysis and Case Studies in Wet Processing Laboratory	0	0	3	2
TC6713	Mini project	0	0	3	2
	<b>TOTAL</b>	<b>18</b>	<b>0</b>	<b>9</b>	<b>24</b>

### SEMESTER – VIII

CODE	COURSE TITLE	L	T	P	C
<b>THEORY</b>					
TC6801	Financial Management in Textile Industry	3	0	0	3
	Elective IV	3	0	0	3
<b>PRACTICALS</b>					
TC6811	Project Work	0	0	12	6
	<b>TOTAL</b>	<b>6</b>	<b>0</b>	<b>12</b>	<b>12</b>

**TOTAL NO OF CREDITS: 189**

## LIST OF ELECTIVES

### B.TECH. TEXTILE CHEMISTRY

#### ELECTIVE I

CODE	COURSE TITLE	L	T	P	C
TC6001	Eco-Friendly dyes, chemicals and Processing	3	0	0	3
TC6002	Modern Printing Technology	3	0	0	3
TC6003	Analysis of Textile Chemicals	3	0	0	3

#### ELECTIVE II

CODE	COURSE TITLE	L	T	P	C
TC6004	Technical Textiles	3	0	0	3
TC6005	Fibre Reinforced Composites	3	0	0	3
TC6006	Clothing Science and Product Engineering	3	0	0	3

#### ELECTIVE – III

CODE	COURSE TITLE	L	T	P	C
TC6007	Nonwoven Fabrics and specialty Fabrics	3	0	0	3
TC6008	Advanced Wet Processing Machinery	3	0	0	3
TC6009	Energy Management and Conservation in Textile Industry	3	0	0	3
GE6084	Human Rights	3	0	0	3

#### ELECTIVE – IV

CODE	COURSE TITLE	L	T	P	C
GE6075	Professional Ethics in Engineering	3	0	0	3
TT6503	Knitting Technology	3	0	0	3
TC6010	Home Textiles	3	0	0	3
GE6083	Disaster Management	3	0	0	3

**OBJECTIVES:**

- To enable learners of Engineering and Technology develop their basic communication skills in English.
- To emphasize specially the development of speaking skills amongst learners of Engineering and Technology.
- To ensure that learners use the electronic media such as internet and supplement the learning materials used in the classroom.
- To inculcate the habit of reading and writing leading to effective and efficient communication.

**UNIT I****9+3**

Listening - Introducing learners to GIE - Types of listening - Listening to audio (verbal & sounds); Speaking - Speaking about one's place, important festivals etc. – Introducing oneself, one's family / friend; Reading - Skimming a reading passage – Scanning for specific information - Note-making; Writing - Free writing on any given topic (My favourite place / Hobbies / School life, etc.) - Sentence completion - Autobiographical writing (writing about one's leisure time activities, hometown, etc.); Grammar - Prepositions - Reference words - Wh-questions - Tenses (Simple); Vocabulary - Word formation - Word expansion (root words / etymology); E-materials - Interactive exercises for Grammar & Vocabulary - Reading comprehension exercises - Listening to audio files and answering questions.

**UNIT II****9+3**

Listening - Listening and responding to video lectures / talks; Speaking - Describing a simple process (filling a form, etc.) - Asking and answering questions - Telephone skills – Telephone etiquette; Reading – Critical reading - Finding key information in a given text - Sifting facts from opinions; Writing - Biographical writing (place, people) - Process descriptions (general/specific) - Definitions - Recommendations – Instructions; Grammar - Use of imperatives - Subject-verb agreement; Vocabulary - Compound words - Word Association (connotation); E-materials - Interactive exercises for Grammar and Vocabulary - Listening exercises with sample telephone conversations / lectures – Picture-based activities.

**UNIT III****9+3**

Listening - Listening to specific task - focused audio tracks; Speaking - Role-play – Simulation - Group interaction - Speaking in formal situations (teachers, officials, foreigners); Reading - Reading and interpreting visual material; Writing - Jumbled sentences - Coherence and cohesion in writing - Channel conversion (flowchart into process) - Types of paragraph (cause and effect / compare and contrast / narrative / analytical) - Informal writing (letter/e-mail/blogs) - Paraphrasing; Grammar - Tenses (Past) - Use of sequence words - Adjectives; Vocabulary - Different forms and uses of words, Cause and effect words; E-materials - Interactive exercises for Grammar and Vocabulary - Excerpts from films related to the theme and follow up exercises - Pictures of flow charts and tables for interpretations.

**UNIT IV****9+3**

Listening - Watching videos / documentaries and responding to questions based on them; Speaking - Responding to questions - Different forms of interviews - Speaking at different types of interviews; Reading - Making inference from the reading passage - Predicting the content of a reading passage; Writing - Interpreting visual materials (line graphs, pie charts etc.) - Essay writing – Different types of essays; Grammar - Adverbs – Tenses – future time reference; Vocabulary - Single word substitutes - Use of abbreviations and acronyms; E-materials - Interactive exercises for Grammar and Vocabulary - Sample interviews - film scenes - dialogue writing.

**UNIT V****9+3**

Listening - Listening to different accents, Listening to Speeches/Presentations, Listening to broadcast and telecast from Radio and TV; Speaking - Giving impromptu talks, Making presentations on given topics; Reading - Email communication - Reading the attachment files

having a poem/joke/proverb - Sending their responses through email; Writing - Creative writing, Poster making; Grammar - Direct and indirect speech; Vocabulary - Lexical items (fixed / semi fixed expressions); E-materials - Interactive exercises for Grammar and Vocabulary - Sending emails with attachment – Audio / video excerpts of different accents - Interpreting posters.

**TOTAL (L:45+T:15): 60 PERIODS**

### **OUTCOMES:**

Learners should be able to

- speak clearly, confidently, comprehensibly, and communicate with one or many listeners using appropriate communicative strategies.
- write cohesively and coherently and flawlessly avoiding grammatical errors, using a wide vocabulary range, organizing their ideas logically on a topic.
- read different genres of texts adopting various reading strategies.
- listen/view and comprehend different spoken discourses/excerpts in different accents

### **TEXTBOOKS:**

1. Department of English, Anna University. Mindscapes: English for Technologists and Engineers. Orient Blackswan, Chennai. 2012
2. Dhanavel, S.P. English and Communication Skills for Students of Science and Engineering. Orient Blackswan, Chennai. 2011

### **REFERENCES:**

1. Raman, Meenakshi & Sangeetha Sharma. Technical Communication: Principles and Practice. Oxford University Press, New Delhi. 2011.
2. Regional Institute of English. English for Engineers. Cambridge University Press, New Delhi. 2006.
3. Rizvi, Ashraf. M. Effective Technical Communication. Tata McGraw-Hill, New Delhi. 2005
4. Rutherford, Andrea. J Basic Communication Skills for Technology. Pearson, New Delhi. 2001.
5. Viswamohan, Aysha. English for Technical Communication. Tata McGraw-Hill, New Delhi. 2008.

### **EXTENSIVE Reading (Not for Examination)**

1. Kalam, Abdul. Wings of Fire. Universities Press, Hyderabad. 1999.

### **WEBSITES:**

1. <http://www.usingenglish.com>
2. <http://www.uefap.com>

### **TEACHING METHODS:**

- Lectures
- Activities conducted individually, in pairs and in groups like self introduction, peer introduction, group poster making, grammar and vocabulary games, etc.
- Discussions
- Role play activities
- Short presentations
- Listening and viewing activities with follow up activities like discussion, filling up worksheets, writing exercises (using language lab wherever necessary/possible) etc.

### **EVALUATION PATTERN:**

#### **Internal assessment: 20%**

3 tests of which two are pen and paper tests and the other is a combination of different modes of assessment like

- Project

- Assignment
- Reviews
- Creative writing
- Poster making, etc.

All the four skills are to be tested with equal weightage given to each.

- ✓ Speaking assessment: Individual speaking activities, Pair work activities like role play, Interview, Group discussions
- ✓ Reading assessment: Reading passages with comprehension questions graded from simple to complex, from direct to inferential
- ✓ Writing assessment: Writing paragraphs, essays etc. Writing should include grammar and vocabulary.
- ✓ Listening/Viewing assessment: Lectures, dialogues, film clippings with questions on verbal as well as audio/visual content.

**End Semester Examination: 80%**

**MA6151**

**MATHEMATICS – I**

**L T P C**  
**3 1 0 4**

**OBJECTIVES:**

- To develop the use of matrix algebra techniques this is needed by engineers for practical applications.
- To make the student knowledgeable in the area of infinite series and their convergence so that he/ she will be familiar with limitations of using infinite series approximations for solutions arising in mathematical modeling.
- To familiarize the student with functions of several variables. This is needed in many branches of engineering.
- To introduce the concepts of improper integrals, Gamma, Beta and Error functions which are needed in engineering applications.
- To acquaint the student with mathematical tools needed in evaluating multiple integrals and their usage.

**UNIT I      MATRICES**

**9+3**

Eigenvalues and Eigenvectors of a real matrix – Characteristic equation – Properties of eigenvalues and eigenvectors – Statement and applications of Cayley-Hamilton Theorem – Diagonalization of matrices – Reduction of a quadratic form to canonical form by orthogonal transformation – Nature of quadratic forms.

**UNIT II      SEQUENCES AND SERIES**

**9+3**

Sequences: Definition and examples – Series: Types and Convergence – Series of positive terms – Tests of convergence: Comparison test, Integral test and D’Alembert’s ratio test – Alternating series – Leibnitz’s test – Series of positive and negative terms – Absolute and conditional convergence.

**UNIT III      APPLICATIONS OF DIFFERENTIAL CALCULUS**

**9+3**

Curvature in Cartesian co-ordinates – Centre and radius of curvature – Circle of curvature – Evolutes – Envelopes - Evolute as envelope of normals.

**UNIT IV      DIFFERENTIAL CALCULUS OF SEVERAL VARIABLES**

**9+3**

Limits and Continuity – Partial derivatives – Total derivative – Differentiation of implicit functions – Jacobian and properties – Taylor’s series for functions of two variables – Maxima and minima of functions of two variables – Lagrange’s method of undetermined multipliers.



**UNIT V MULTIPLE INTEGRALS****9+3**

Double integrals in cartesian and polar coordinates – Change of order of integration – Area enclosed by plane curves – Change of variables in double integrals – Area of a curved surface - Triple integrals – Volume of Solids.

**TOTAL (L:45+T:15): 60 PERIODS****OUTCOMES:**

- This course equips students to have basic knowledge and understanding in one fields of materials, integral and differential calculus.

**TEXT BOOKS:**

1. Bali N. P and Manish Goyal, "A Text book of Engineering Mathematics", Eighth Edition, Laxmi Publications Pvt Ltd., 2011.
2. Grewal. B.S, "Higher Engineering Mathematics", 41<sup>st</sup> Edition, Khanna Publications, Delhi, 2011.

**REFERENCES:**

1. Dass, H.K., and Er. Rajnish Verma," Higher Engineering Mathematics", S. Chand Private Ltd., 2011.
2. Glyn James, "Advanced Modern Engineering Mathematics", 3<sup>rd</sup> Edition, Pearson Education, 2012.
3. Peter V. O'Neil," Advanced Engineering Mathematics", 7th Edition, Cengage learning, 2012.
4. Ramana B.V, "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company, New Delhi, 2008.
5. Sivarama Krishna Das P. and Rukmangadachari E., "Engineering Mathematics", Volume I, Second Edition, PEARSON Publishing, 2011.

**PH6151****ENGINEERING PHYSICS – I****L T P C  
3 0 0 3****OBJECTIVES:**

- To enhance the fundamental knowledge in Physics and its applications relevant to various streams of Engineering and Technology.

**UNIT I CRYSTAL PHYSICS****9**

Lattice – Unit cell – Bravais lattice – Lattice planes – Miller indices – d spacing in cubic lattice – Calculation of number of atoms per unit cell – Atomic radius – Coordination number – Packing factor for SC, BCC, FCC and HCP structures – Diamond and graphite structures (qualitative treatment) - Crystal growth techniques –solution, melt (Bridgman and Czochralski) and vapour growth techniques (qualitative)

**UNIT II PROPERTIES OF MATTER AND THERMAL PHYSICS****9**

Elasticity- Hooke's law - Relationship between three moduli of elasticity (qualitative) – stress -strain diagram – Poisson's ratio –Factors affecting elasticity –Bending moment – Depression of a cantilever –Young's modulus by uniform bending- I-shaped girders  
Modes of heat transfer- thermal conductivity- Newton's law of cooling - Linear heat flow – Lee's disc method – Radial heat flow – Rubber tube method – conduction through compound media (series and parallel)

**UNIT III QUANTUM PHYSICS****9**

Black body radiation – Planck's theory (derivation) – Deduction of Wien's displacement law and Rayleigh – Jeans' Law from Planck's theory – Compton effect. Theory and experimental verification – Properties of Matter waves – G.P Thomson experiment -Schrödinger's wave equation – Time independent and time dependent equations – Physical significance of wave function – Particle in a

one dimensional box - Electron microscope - Scanning electron microscope - Transmission electron microscope.

#### **UNIT IV ACOUSTICS AND ULTRASONICS 9**

Classification of Sound- decibel- Weber–Fechner law – Sabine’s formula- derivation using growth and decay method – Absorption Coefficient and its determination –factors affecting acoustics of buildings and their remedies.

Production of ultrasonics by magnetostriction and piezoelectric methods - acoustic grating -Non Destructive Testing – pulse echo system through transmission and reflection modes - A,B and C – scan displays, Medical applications - Sonogram

#### **UNIT V PHOTONICS AND FIBRE OPTICS 9**

Spontaneous and stimulated emission- Population inversion -Einstein’s A and B coefficients - derivation. Types of lasers – Nd:YAG, CO<sub>2</sub>, Semiconductor lasers (homojunction & heterojunction)- Industrial and Medical Applications.

Principle and propagation of light in optical fibres – Numerical aperture and Acceptance angle - Types of optical fibres (material, refractive index, mode) – attenuation, dispersion, bending - Fibre Optical Communication system (Block diagram) - Active and passive fibre sensors- Endoscope.

**TOTAL: 45 PERIODS**

#### **OUTCOMES:**

- The students will have knowledge on the basics of physics related to properties of matter, optics, acoustics etc., and they will apply these fundamental principles to solve practical problems related to materials used for engineering applications.

#### **TEXT BOOKS:**

1. Arumugam M. Engineering Physics. Anuradha publishers, 2010
2. Gaur R.K. and Gupta S.L. Engineering Physics. Dhanpat Rai publishers, 2009
3. Mani Naidu S. Engineering Physics, Second Edition, PEARSON Publishing, 2011.

#### **REFERENCES:**

1. Searls and Zemansky. University Physics, 2009
2. Mani P. Engineering Physics I. Dhanam Publications, 2011
3. Marikani A. Engineering Physics. PHI Learning Pvt., India, 2009
4. Palanisamy P.K. Engineering Physics. SCITECH Publications, 2011
5. Rajagopal K. Engineering Physics. PHI, New Delhi, 2011
6. Senthilkumar G. Engineering Physics I. VRB Publishers, 2011.

**CY6151**

**ENGINEERING CHEMISTRY - I**

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

#### **OBJECTIVES:**

- To make the students conversant with basics of polymer chemistry.
- To make the student acquire sound knowledge of second law of thermodynamics and second law based derivations of importance in engineering applications in all disciplines.
- To acquaint the student with concepts of important photophysical and photochemical processes and spectroscopy.
- To develop an understanding of the basic concepts of phase rule and its applications to single and two component systems and appreciate the purpose and significance of alloys.
- To acquaint the students with the basics of nano materials, their properties and applications.

#### **UNIT I POLYMER CHEMISTRY 9**

Introduction: Classification of polymers – Natural and synthetic; Thermoplastic and Thermosetting.

Functionality – Degree of polymerization. Types and mechanism of polymerization: Addition (Free Radical, cationic and anionic); condensation and copolymerization. Properties of polymers: T<sub>g</sub>, Tacticity, Molecular weight – weight average, number average and polydispersity index. Techniques of polymerization: Bulk, emulsion, solution and suspension. Preparation, properties and uses of Nylon 6,6, and Epoxy resin.

## **UNIT II CHEMICAL THERMODYNAMICS 9**

Terminology of thermodynamics - Second law: Entropy - entropy change for an ideal gas, reversible and irreversible processes; entropy of phase transitions; Clausius inequality. Free energy and work function: Helmholtz and Gibbs free energy functions (problems); Criteria of spontaneity; Gibbs-Helmholtz equation (problems); Clausius-Clapeyron equation; Maxwell relations – Van't Hoff isotherm and isochore (problems).

## **UNIT III PHOTOCHEMISTRY AND SPECTROSCOPY 9**

Photochemistry: Laws of photochemistry - Grothuss–Draper law, Stark–Einstein law and Lambert-Beer Law. Quantum efficiency – determination- Photo processes - Internal Conversion, Inter-system crossing, Fluorescence, Phosphorescence, Chemiluminescence and Photo-sensitization. Spectroscopy: Electromagnetic spectrum - Absorption of radiation – Electronic, Vibrational and rotational transitions. UV-visible and IR spectroscopy – principles, instrumentation (Block diagram only).

## **UNIT IV PHASE RULE AND ALLOYS 9**

Phase rule: Introduction, definition of terms with examples, One Component System- water system - Reduced phase rule - Two Component Systems- classification – lead-silver system, zinc-magnesium system. Alloys: Introduction- Definition- Properties of alloys- Significance of alloying, Functions and effect of alloying elements- Ferrous alloys- Nichrome and Stainless steel – heat treatment of steel; Non-ferrous alloys – brass and bronze.

## **UNIT V NANOCHEMISTRY 9**

Basics - distinction between molecules, nanoparticles and bulk materials; size-dependent properties. Nanoparticles: nano cluster, nano rod, nanotube(CNT) and nanowire. Synthesis: precipitation, thermolysis, hydrothermal, solvothermal, electrode position, chemical vapour deposition, laser ablation; Properties and applications

**TOTAL :45 PERIODS**

### **OUTCOMES:**

- The knowledge gained on polymer chemistry, thermodynamics, spectroscopy, phase rule and nano materials will provide a strong platform to understand the concepts on these subjects for further learning.

### **TEXT BOOKS:**

1. Jain P.C. and Monica Jain, "Engineering Chemistry", Dhanpat Rai Publishing Company (P) Ltd., New Delhi, 2010
2. Kannan P., Ravikrishnan A., "Engineering Chemistry", Sri Krishna Hi-tech Publishing Company Pvt. Ltd. Chennai, 2009

### **REFERENCES:**

1. Dara S.S, Umare S.S, "Engineering Chemistry", S. Chand & Company Ltd., New Delhi 2010
2. Sivasankar B., "Engineering Chemistry", Tata McGraw-Hill Publishing Company, Ltd., New Delhi, 2008.
3. Gowariker V.R. , Viswanathan N.V. and JayadevSreedhar, "Polymer Science", New Age International P (Ltd.), Chennai, 2006.
4. Ozin G. A. and Arsenault A. C., "Nanotechnology: A Chemical Approach to Nanomaterials", RSC Publishing, 2005.

**OBJECTIVES:**

The students should be made to:

- Learn the organization of a digital computer.
- Be exposed to the number systems.
- Learn to think logically and write pseudo code or draw flow charts for problems.
- Be exposed to the syntax of C.
- Be familiar with programming in C.
- Learn to use arrays, strings, functions, pointers, structures and unions in C.

**UNIT I INTRODUCTION****8**

Generation and Classification of Computers- Basic Organization of a Computer –Number System – Binary – Decimal – Conversion – Problems. Need for logical analysis and thinking – Algorithm – Pseudo code – Flow Chart.

**UNIT II C PROGRAMMING BASICS****10**

Problem formulation – Problem Solving - Introduction to 'C' programming –fundamentals – structure of a 'C' program – compilation and linking processes – Constants, Variables – Data Types – Expressions using operators in 'C' – Managing Input and Output operations – Decision Making and Branching – Looping statements – solving simple scientific and statistical problems.

**UNIT III ARRAYS AND STRINGS****9**

Arrays – Initialization – Declaration – One dimensional and Two dimensional arrays. String- String operations – String Arrays. Simple programs- sorting- searching – matrix operations.

**UNIT IV FUNCTIONS AND POINTERS****9**

Function – definition of function – Declaration of function – Pass by value – Pass by reference – Recursion – Pointers - Definition – Initialization – Pointers arithmetic – Pointers and arrays- Example Problems.

**UNIT V STRUCTURES AND UNIONS****9**

Introduction – need for structure data type – structure definition – Structure declaration – Structure within a structure - Union - Programs using structures and Unions – Storage classes, Pre-processor directives.

**TOTAL: 45 PERIODS****OUTCOMES:**

At the end of the course, the student should be able to:

- Design C Programs for problems.
- Write and execute C programs for simple applications.

**TEXTBOOKS:**

1. Anita Goel and Ajay Mittal, "Computer Fundamentals and Programming in C", Dorling Kindersley (India) Pvt. Ltd., Pearson Education in South Asia, 2011.
2. Pradip Dey, Manas Ghosh, "Fundamentals of Computing and Programming in C", First Edition, Oxford University Press, 2009
3. Yashavant P. Kanetkar. "Let Us C", BPB Publications, 2011.

**REFERENCES:**

1. Byron S Gottfried, "Programming with C", Schaum's Outlines, Second Edition, Tata McGraw-Hill, 2006.
2. Dromey R.G., "How to Solve it by Computer", Pearson Education, Fourth Reprint, 2007.
3. Kernighan,B.W and Ritchie,D.M, "The C Programming language", Second Edition, Pearson Education, 2006.

**OBJECTIVES:**

- To develop in students, graphic skills for communication of concepts, ideas and design of Engineering products.
- To expose them to existing national standards related to technical drawings.

**CONCEPTS AND CONVENTIONS (Not for Examination)****1**

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 FREE HAND SKETCHING****5+9**

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, Scales: Construction of Diagonal and Vernier scales.

Visualization concepts and Free Hand sketching: Visualization principles –Representation of Three Dimensional objects – Layout of views- Free hand sketching of multiple views from pictorial views of objects

**UNIT II PROJECTION OF POINTS, LINES AND PLANE SURFACES****5+9**

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****5+9**

Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to one of the principal planes by rotating object method and auxiliary plane method.

**UNIT IV PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES****5+9**

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. Development of lateral surfaces of solids with cut-outs and holes

**UNIT V ISOMETRIC AND PERSPECTIVE PROJECTIONS****6+9**

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 and miscellaneous problems. Perspective projection of simple solids-Prisms, pyramids and cylinders by visual ray method .

**COMPUTER AIDED DRAFTING (Demonstration Only)****3**

Introduction to drafting packages and demonstration of their use.

**TOTAL: 75 PERIODS****OUTCOMES:**

On Completion of the course the student will be able to

- perform free hand sketching of basic geometrical constructions and multiple views of objects.
- do orthographic projection of lines and plane surfaces.
- draw projections and solids and development of surfaces.
- prepare isometric and perspective sections of simple solids.

- demonstrate computer aided drafting.

**TEXT BOOK:**

1. Bhatt N.D. and Panchal V.M., “Engineering Drawing”, Charotar Publishing House, 50<sup>th</sup> Edition, 2010.

**REFERENCES:**

1. Gopalakrishna K.R., “Engineering Drawing” (Vol. I&II combined), Subhas Stores, Bangalore, 2007.
2. 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.
3. Shah M.B., and Rana B.C., “Engineering Drawing”, Pearson, 2<sup>nd</sup> Edition, 2009.
4. Venugopal K. and Prabhu Raja V., “Engineering Graphics”, New Age International (P) Limited, 2008.
5. Natrajan K.V., “A text book of Engineering Graphics”, Dhanalakshmi Publishers, Chennai, 2009.
6. Basant Agarwal and Agarwal C.M., “Engineering Drawing”, Tata McGraw Hill Publishing Company Limited, New Delhi, 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

**GE6161**

**COMPUTER PRACTICES LABORATORY**

**L T P C  
0 0 3 2**

**OBJECTIVES:**

**The student should be made to:**

- Be familiar with the use of Office software.
- Be exposed to presentation and visualization tools.
- Be exposed to problem solving techniques and flow charts.
- Be familiar with programming in C.
- Learn to use Arrays, strings, functions, structures and unions.

**LIST OF EXPERIMENTS:**

1. Search, generate, manipulate data using MS office/ Open Office
2. Presentation and Visualization – graphs, charts, 2D, 3D
3. Problem formulation, Problem Solving and Flowcharts
4. C Programming using Simple statements and expressions

5. Scientific problem solving using decision making and looping.
6. Simple programming for one dimensional and two dimensional arrays.
7. Solving problems using String functions
8. Programs with user defined functions – Includes Parameter Passing
9. Program using Recursive Function and conversion from given program to flow chart.
10. Program using structures and unions.

**TOTAL : 45 PERIODS**

**OUTCOMES:**

**At the end of the course, the student should be able to:**

- Apply good programming design methods for program development.
- Design and implement C programs for simple applications.
- Develop recursive programs.

**LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS:**

Standalone desktops with C compiler                      30 Nos.

(or)

Server with C compiler supporting 30 terminals or more.

**GE6162**

**ENGINEERING PRACTICES LABORATORY**

**L T P C**  
**0 0 3 2**

**OBJECTIVES:**

- To provide exposure to the students with hands on experience on various basic engineering practices in Civil, Mechanical, Electrical and Electronics Engineering.

**GROUP A (CIVIL & MECHANICAL)**

**I            CIVIL ENGINEERING PRACTICE**

**9**

**Buildings:**

- (a) Study of plumbing and carpentry components of residential and industrial buildings. Safety aspects.

**Plumbing Works:**

- (a) Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, elbows in household fittings.
- (b) Study of pipe connections requirements for pumps and turbines.
- (c) Preparation of plumbing line sketches for water supply and sewage works.
- (d) Hands-on-exercise:

Basic pipe connections – Mixed pipe material connection – Pipe connections with different joining components.

- (e) Demonstration of plumbing requirements of high-rise buildings.

**Carpentry using Power Tools only:**

- (a) Study of the joints in roofs, doors, windows and furniture.
- (b) Hands-on-exercise:

Wood work, joints by sawing, planing and cutting.

**Welding:**

- (a) Preparation of arc welding of butt joints, lap joints and tee joints.
- (b) Gas welding practice

**Basic Machining:**

- (a) Simple Turning and Taper turning
- (b) Drilling Practice

**Sheet Metal Work:**

- (a) Forming & Bending:
- (b) Model making – Trays, funnels, etc.
- (c) Different type of joints.

**Machine assembly practice:**

- (a) Study of centrifugal pump
- (b) Study of air conditioner

**Demonstration on:**

- (a) Smithy operations, upsetting, swaging, setting down and bending. Example – Exercise – Production of hexagonal headed bolt.
- (b) Foundry operations like mould preparation for gear and step cone pulley.
- (c) Fitting – Exercises – Preparation of square fitting and vee – fitting models.

**GROUP B (ELECTRICAL & ELECTRONICS)****III ELECTRICAL ENGINEERING PRACTICE****10**

1. Residential house wiring using switches, fuse, indicator, lamp and energy meter.
2. Fluorescent lamp wiring.
3. Stair case wiring
4. Measurement of electrical quantities – voltage, current, power & power factor in RLC circuit.
5. Measurement of energy using single phase energy meter.
6. Measurement of resistance to earth of an electrical equipment.

**IV ELECTRONICS ENGINEERING PRACTICE****13**

1. Study of Electronic components and equipments – Resistor, colour coding measurement of AC signal parameter (peak-peak, rms period, frequency) using CR.
2. Study of logic gates AND, OR, EOR and NOT.
3. Generation of Clock Signal.
4. Soldering practice – Components Devices and Circuits – Using general purpose PCB.
5. Measurement of ripple factor of HWR and FWR.

**TOTAL: 45 PERIODS****OUTCOMES:**

- ability to fabricate carpentry components and pipe connections including plumbing works.
- ability to use welding equipments to join the structures.
- ability to fabricate electrical and electronics circuits.

**REFERENCES:**

1. Jeyachandran K., Natarajan S. & Balasubramanian S., "A Primer on Engineering Practices Laboratory", Anuradha Publications, 2007.
2. Jeyapooan T., Saravanapandian M. & Pranitha S., "Engineering Practices Lab Manual", Vikas Pupliching House Pvt.Ltd, 2006.
3. Bawa H.S., "Workshop Practice", Tata McGraw – Hill Publishing Company Limited, 2007.
4. Rajendra Prasad A. & Sarma P.M.M.S., "Workshop Practice", Sree Sai Publication, 2002.



5. Kannaiah P. & Narayana K.L., "Manual on Workshop Practice", Scitech Publications, 1999.

### **LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:**

#### **CIVIL**

- |   |          |
|---|----------|
| 1. Assorted components for plumbing consisting of metallic pipes, plastic pipes, flexible pipes, couplings, unions, elbows, plugs and other fittings. | 15 Sets. |
| 2. Carpentry vice (fitted to work bench)  | 15 Nos.  |
| 3. Standard woodworking tools   | 15 Sets. |
| 4. Models of industrial trusses, door joints, furniture joints  | 5 each   |
| 5. Power Tools: (a) Rotary Hammer   | 2 Nos    |
| (b) Demolition Hammer   | 2 Nos    |
| (c) Circular Saw  | 2 Nos    |
| (d) Planer  | 2 Nos    |
| (e) Hand Drilling Machine   | 2 Nos    |
| (f) Jigsaw  | 2 Nos    |

#### **MECHANICAL**

- |   |           |
|---|-----------|
| 1. Arc welding transformer with cables and holders                            | 5 Nos.    |
| 2. Welding booth with exhaust facility  | 5 Nos.    |
| 3. Welding accessories like welding shield, chipping hammer, wire brush, etc. | 5 Sets.   |
| 4. Oxygen and acetylene gas cylinders, blow pipe and other welding outfit.    | 2 Nos.    |
| 5. Centre lathe   | 2 Nos.    |
| 6. Hearth furnace, anvil and smithy tools                                     | 2 Sets.   |
| 7. Moulding table, foundry tools  | 2 Sets.   |
| 8. Power Tool: Angle Grinder  | 2 Nos     |
| 9. Study-purpose items: centrifugal pump, air-conditioner                     | One each. |

#### **ELECTRICAL**

- |   |         |
|---|---------|
| 1. Assorted electrical components for house wiring                  | 15 Sets |
| 2. Electrical measuring instruments                                 | 10 Sets |
| 3. Study purpose items: Iron box, fan and regulator, emergency lamp | 1 each  |
| 4. Megger (250V/500V)   | 1 No.   |
| 5. Power Tools: (a) Range Finder                                    | 2 Nos   |
| (b) Digital Live-wire detector                                      | 2 Nos   |

#### **ELECTRONICS**

- |   |         |
|---|---------|
| 1. Soldering guns   | 10 Nos. |
| 2. Assorted electronic components for making circuits                 | 50 Nos. |
| 3. Small PCBs   | 10 Nos. |
| 4. Multimeters  | 10 Nos. |
| 5. Study purpose items: Telephone, FM radio, low-voltage power supply |         |

**PHYSICS LABORATORY – I****OBJECTIVES:**

- To introduce different experiments to test basic understanding of physics concepts applied in optics, thermal physics and properties of matter.

**LIST OF EXPERIMENTS**

(Any FIVE Experiments)

- (a) Determination of Wavelength, and particle size using Laser  
(b) Determination of acceptance angle in an optical fiber.
- Determination of velocity of sound and compressibility of liquid – Ultrasonic interferometer.
- Determination of wavelength of mercury spectrum – spectrometer grating
- Determination of thermal conductivity of a bad conductor – Lee's Disc method.
- Determination of Young's modulus by Non uniform bending method
- Determination of specific resistance of a given coil of wire – Carey Foster's Bridge

**OUTCOMES:**

- The hands on exercises undergone by the students will help them to apply physics principles of optics and thermal physics to evaluate engineering properties of materials.

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:**

- Diode laser, lycopodium powder, glass plate, optical fiber.
- Ultrasonic interferometer
- Spectrometer, mercury lamp, grating
- Lee's Disc experimental set up
- Traveling microscope, meter scale, knife edge, weights
- Carey foster's bridge set up  
(vernier Caliper, Screw gauge, reading lens are required for most of the experiments)

**CHEMISTRY LABORATORY- I****OBJECTIVES:**

- To make the student to acquire practical skills in the determination of water quality parameters through volumetric and instrumental analysis.
- To acquaint the students with the determination of molecular weight of a polymer by vacometry.

**LIST OF EXPERIMENTS**

(Any FIVE Experiments)

- Determination of DO content of water sample by Winkler's method.
- Determination of chloride content of water sample by argentometric method.
- Determination of strength of given hydrochloric acid using pH meter.
- Determination of strength of acids in a mixture using conductivity meter.
- Estimation of iron content of the water sample using spectrophotometer.  
(1,10- phenanthroline / thiocyanate method).
- Determination of molecular weight of polyvinylalcohol using Ostwald viscometer.
- Conductometric titration of strong acid vs strong base.

**OUTCOMES:**

- The students will be outfitted with hands-on knowledge in the quantitative chemical analysis of water quality related parameters.

**REFERENCES:**

1. Daniel R. Palleros, "Experimental organic chemistry" John Wiley & Sons, Inc., New York 2001.
2. Furniss B.S. Hannaford A.J, Smith P.W.G and Tatchel A.R., "Vogel's Textbook of practical organic chemistry", LBS Singapore 1994.
3. Jeffery G.H., Bassett J., Mendham J. and Denny vogel's R.C, "Text book of quantitative analysis chemical analysis", ELBS 5th Edn. Longman, Singapore publishers, Singapore, 1996.
4. Kolthoff I.M., Sandell E.B. et al. "Quantitative chemical analysis", Mcmillan, Madras 1980.

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:**

1. Iodine flask	-	30 Nos
2. pH meter	-	5 Nos
3. Conductivity meter	-	5 Nos
4. Spectrophotometer	-	5 Nos
5. Ostwald Viscometer	-	10 Nos

**Common Apparatus : Pipette, Burette, conical flask, porcelain tile, dropper (each 30 Nos.)**

**HS6251****TECHNICAL ENGLISH II**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**OBJECTIVES:**

- To make learners acquire listening and speaking skills in both formal and informal contexts.
- To help them develop their reading skills by familiarizing them with different types of reading strategies.
- To equip them with writing skills needed for academic as well as workplace contexts.
- To make them acquire language skills at their own pace by using e-materials and language lab components.

**UNIT I****9+3**

Listening - Listening to informal conversations and participating; Speaking - Opening a conversation (greetings, comments on topics like weather) - Turn taking - Closing a conversation (excuses, general wish, positive comment, thanks); Reading - Developing analytical skills, Deductive and inductive reasoning - Extensive reading; Writing - Effective use of SMS for sending short notes and messages - Using 'emoticons' as symbols in email messages; Grammar - Regular and irregular verbs - Active and passive voice; Vocabulary - Homonyms (e.g. 'can') - Homophones (e.g. 'some', 'sum'); E-materials - Interactive exercise on Grammar and vocabulary – blogging; Language Lab - Listening to different types of conversation and answering questions.

**UNIT II****9+3**

Listening - Listening to situation based dialogues; Speaking - Conversation practice in real life situations, asking for directions (using polite expressions), giving directions (using imperative sentences), Purchasing goods from a shop, Discussing various aspects of a film (they have already seen) or a book (they have already read); Reading - Reading a short story or an article from newspaper, Critical reading, Comprehension skills; Writing - Writing a review / summary of a story / article, Personal letter (Inviting your friend to a function, congratulating someone for his / her success, thanking one's friends / relatives); Grammar - modal verbs, Purpose expressions;

Vocabulary - Phrasal verbs and their meanings, Using phrasal verbs in sentences; E-materials - Interactive exercises on Grammar and vocabulary, Extensive reading activity (reading stories / novels), Posting reviews in blogs - Language Lab - Dialogues (Fill up exercises), Recording students' dialogues.

### **UNIT III**

**9+3**

Listening - Listening to the conversation - Understanding the structure of conversations; Speaking - Conversation skills with a sense of stress, intonation, pronunciation and meaning - Seeking information – expressing feelings (affection, anger, regret, etc.); Reading - Speed reading – reading passages with time limit - Skimming; Writing - Minutes of meeting – format and practice in the preparation of minutes - Writing summary after reading articles from journals - Format for journal articles – elements of technical articles (abstract, introduction, methodology, results, discussion, conclusion, appendices, references) - Writing strategies; Grammar - Conditional clauses - Cause and effect expressions; Vocabulary - Words used as nouns and verbs without any change in the spelling (e.g. 'rock', 'train', 'ring'); E-materials - Interactive exercise on Grammar and vocabulary - Speed Reading practice exercises; Language Lab - Intonation practice using EFLU and RIE materials – Attending a meeting and writing minutes.

### **UNIT IV**

**9+3**

Listening - Listening to a telephone conversation, Viewing model interviews (face-to-face, telephonic and video conferencing); Speaking - Role play practice in telephone skills - listening and responding, -asking questions, -note taking – passing on messages, Role play and mock interview for grasping interview skills; Reading - Reading the job advertisements and the profile of the company concerned – scanning; Writing - Applying for a job – cover letter - résumé preparation – vision, mission and goals of the candidate; Grammar - Numerical expressions - Connectives (discourse markers); Vocabulary - Idioms and their meanings – using idioms in sentences; E-materials - Interactive exercises on Grammar and Vocabulary - Different forms of résumés- Filling up a résumé / cover letter; Language Lab - Telephonic interview – recording the responses - e-résumé writing.

### **UNIT V**

**9+3**

Listening - Viewing a model group discussion and reviewing the performance of each participant - Identifying the characteristics of a good listener; Speaking - Group discussion skills – initiating the discussion – exchanging suggestions and proposals – expressing dissent/agreement – assertiveness in expressing opinions – mind mapping technique; Reading - Note making skills – making notes from books, or any form of written materials - Intensive reading; Writing – Checklist - Types of reports – Feasibility / Project report – report format – recommendations / suggestions – interpretation of data (using charts for effective presentation); Grammar - Use of clauses; Vocabulary – Collocation; E-materials - Interactive grammar and vocabulary exercises - Sample GD - Pictures for discussion, Interactive grammar and vocabulary exercises; Language Lab - Different models of group discussion.

**TOTAL (L:45+T:15): 60 PERIODS**

### **OUTCOMES:**

Learners should be able to

- speak convincingly, express their opinions clearly, initiate a discussion, negotiate, argue using appropriate communicative strategies.
- write effectively and persuasively and produce different types of writing such as narration, description, exposition and argument as well as creative, critical, analytical and evaluative writing.
- read different genres of texts, infer implied meanings and critically analyse and evaluate them for ideas as well as for method of presentation.
- listen/view and comprehend different spoken excerpts critically and infer unspoken and implied meanings.

### **TEXTBOOKS:**

1. Department of English, Anna University. Mindscapes: English for Technologists and Engineers. Orient Blackswan, Chennai. 2012
2. Dhanavel, S.P. English and Communication Skills for Students of Science and Engineering. Orient Blackswan, Chennai. 2011

#### REFERENCES:

1. Anderson, Paul V. Technical Communication: A Reader-Centered Approach. Cengage. New Delhi. 2008
2. Muralikrishna, & Sunita Mishra. Communication Skills for Engineers. Pearson, New Delhi. 2011
3. Riordan, Daniel. G. Technical Communication. Cengage Learning, New Delhi. 2005
4. Sharma, Sangeetha & Binod Mishra. Communication Skills for Engineers and Scientists. PHI Learning, New Delhi. 2009
5. Smith-Worthington, Darlene & Sue Jefferson. Technical Writing for Success. Cengage, Mason USA. 2007

#### EXTENSIVE Reading (Not for Examination)

1. Khera, Shiv. You can Win. Macmillan, Delhi. 1998.

#### Websites

1. <http://www.englishclub.com>
2. <http://owl.english.purdue.edu>

#### TEACHING METHODS:

- Lectures
- Activities conducted individually, in pairs and in groups like individual writing and presentations, group discussions, interviews, reporting, etc
- Long presentations using visual aids
- Listening and viewing activities with follow up activities like discussions, filling up worksheets, writing exercises (using language lab wherever necessary/possible) etc
- Projects like group reports, mock interviews etc using a combination of two or more of the language skills

#### EVALUATION PATTERN:

##### Internal assessment: 20%

3 tests of which two are pen and paper tests and the other is a combination of different modes of assessment like

- Project
- Assignment
- Report
- Creative writing, etc.

All the four skills are to be tested with equal weightage given to each.

- ✓ Speaking assessment: Individual presentations, Group discussions
- ✓ Reading assessment: Reading passages with comprehension questions graded following Bloom's taxonomy
- ✓ Writing assessment: Writing essays, CVs, reports etc. Writing should include grammar and vocabulary.
- ✓ Listening/Viewing assessment: Lectures, dialogues, film clippings with questions on verbal as well as audio/visual content graded following Bloom's taxonomy.

##### End Semester Examination: 80%

**OBJECTIVES:**

- To make the student acquire sound knowledge of techniques in solving ordinary differential equations that model engineering problems.
- To acquaint the student with the concepts of vector calculus needed for problems in all engineering disciplines.
- To develop an understanding of the standard techniques of complex variable theory so as to enable the student to apply them with confidence, in application areas such as heat conduction, elasticity, fluid dynamics and flow the of electric current.
- To make the student appreciate the purpose of using transforms to create a new domain in which it is easier to handle the problem that is being investigated.

**UNIT I VECTOR CALCULUS 9+3**

Gradient, divergence and curl – Directional derivative – Irrotational and solenoidal vector fields – Vector integration – Green's theorem in a plane, Gauss divergence theorem and Stokes' theorem (excluding proofs) – Simple applications involving cubes and rectangular parallelepipeds.

**UNIT II ORDINARY DIFFERENTIAL EQUATIONS 9+3**

Higher order linear differential equations with constant coefficients – Method of variation of parameters – Cauchy's and Legendre's linear equations – Simultaneous first order linear equations with constant coefficients.

**UNIT III LAPLACE TRANSFORM 9+3**

Laplace transform – Sufficient condition for existence – Transform of elementary functions – Basic properties – Transforms of derivatives and integrals of functions - Derivatives and integrals of transforms - Transforms of unit step function and impulse functions – Transform of periodic functions. Inverse Laplace transform -Statement of Convolution theorem – Initial and final value theorems – Solution of linear ODE of second order with constant coefficients using Laplace transformation techniques.

**UNIT IV ANALYTIC FUNCTIONS 9+3**

Functions of a complex variable – Analytic functions: Necessary conditions – Cauchy-Riemann equations and sufficient conditions (excluding proofs) – Harmonic and orthogonal properties of analytic function – Harmonic conjugate – Construction of analytic functions – Conformal mapping:  $w = z+k$ ,  $kz$ ,  $1/z$ ,  $z^2$ ,  $e^z$  and bilinear transformation.

**UNIT V COMPLEX INTEGRATION 9+3**

Complex integration – Statement and applications of Cauchy's integral theorem and Cauchy's integral formula – Taylor's and Laurent's series expansions – Singular points – Residues – Cauchy's residue theorem – Evaluation of real definite integrals as contour integrals around unit circle and semi-circle (excluding poles on the real axis).

**TOTAL (L:45+T:15): 60 PERIODS**

**OUTCOMES:**

- The subject helps the students to develop the fundamentals and basic concepts in vector calculus, ODE, Laplace transform and complex functions. Students will be able to solve problems related to engineering applications by using these techniques.

**TEXT BOOKS:**

1. Bali N. P and Manish Goyal, "A Text book of Engineering Mathematics", Eighth Edition, Laxmi Publications Pvt Ltd.,2011.
2. Grewal. B.S, "Higher Engineering Mathematics", 41<sup>st</sup> Edition, Khanna Publications, Delhi, 2011.

**REFERENCES:**

1. Dass, H.K., and Er. Rajnish Verma," Higher Engineering Mathematics", S. Chand Private Ltd., 2011
2. Glyn James, "Advanced Modern Engineering Mathematics", 3<sup>rd</sup> Edition, Pearson Education, 2012.
3. Peter V. O'Neil," Advanced Engineering Mathematics", 7th Edition, Cengage learning, 2012.
4. Ramana B.V, "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company, New Delhi, 2008.
5. Sivarama Krishna Das P. and Rukmangadachari E., "Engineering Mathematics" Volume II, Second Edition, PEARSON Publishing, 2011.

**PH6251****ENGINEERING PHYSICS – II****L T P C  
3 0 0 3****OBJECTIVES:**

- To enrich the understanding of various types of materials and their applications in engineering and technology.

**UNIT I CONDUCTING MATERIALS 9**

Conductors – classical free electron theory of metals – Electrical and thermal conductivity – Wiedemann – Franz law – Lorentz number – Draw backs of classical theory – Quantum theory – Fermi distribution function – Effect of temperature on Fermi Function – Density of energy states – carrier concentration in metals.

**UNIT II SEMICONDUCTING MATERIALS 9**

Intrinsic semiconductor – carrier concentration derivation – Fermi level – Variation of Fermi level with temperature – electrical conductivity – band gap determination – compound semiconductors - direct and indirect band gap- derivation of carrier concentration in n-type and p-type semiconductor – variation of Fermi level with temperature and impurity concentration — Hall effect –Determination of Hall coefficient – Applications.

**UNIT III MAGNETIC AND SUPERCONDUCTING MATERIALS 9**

Origin of magnetic moment – Bohr magneton – comparison of Dia, Para and Ferro magnetism – Domain theory – Hysteresis – soft and hard magnetic materials – antiferromagnetic materials – Ferrites and its applications

Superconductivity: properties – Type I and Type II superconductors – BCS theory of superconductivity(Qualitative) - High  $T_c$  superconductors – Applications of superconductors – SQUID, cryotron, magnetic levitation.

**UNIT IV DIELECTRIC MATERIALS 9**

Electrical susceptibility – dielectric constant – electronic, ionic, orientational and space charge polarization – frequency and temperature dependence of polarisation – internal field – Clausius – Mosotti relation (derivation) – dielectric loss – dielectric breakdown – uses of dielectric materials (capacitor and transformer) – ferroelectricity and applications.

**UNIT V ADVANCED ENGINEERING MATERIALS 9**

Metallic glasses: preparation, properties and applications. Shape memory alloys (SMA): Characteristics, properties of NiTi alloy, application, Nanomaterials– Preparation -pulsed laser deposition – chemical vapour deposition – Applications – NLO materials –Birefringence- optical Kerr effect – Classification of Biomaterials and its applications

**TOTAL: 45 PERIODS**

**OUTCOMES:**

- The students will have the knowledge on physics of materials and that knowledge will be used by them in different engineering and technology applications.

**TEXT BOOKS:**

1. Arumugam M., Materials Science. Anuradha publishers, 2010
2. Pillai S.O., Solid State Physics. New Age International(P) Ltd., publishers, 2009

**REFERENCES:**

1. Palanisamy P.K. Materials Science. SCITECH Publishers, 2011
2. Senthilkumar G. Engineering Physics II. VRB Publishers, 2011
3. Mani P. Engineering Physics II. Dhanam Publications, 2011
4. Marikani A. Engineering Physics. PHI Learning Pvt., India, 2009

**CY6251****ENGINEERING CHEMISTRY - II****L T P C  
3 0 0 3****OBJECTIVES:**

- To make the students conversant with boiler feed water requirements, related problems and water treatment techniques.
- Principles of electrochemical reactions, redox reactions in corrosion of materials and methods for corrosion prevention and protection of materials.
- Principles and generation of energy in batteries, nuclear reactors, solar cells, wind mills and fuel cells.
- Preparation, properties and applications of engineering materials.
- Types of fuels, calorific value calculations, manufacture of solid, liquid and gaseous fuels.

**UNIT I WATER TECHNOLOGY****9**

Introduction to boiler feed water-requirements-formation of deposits in steam boilers and heat exchangers- disadvantages (wastage of fuels, decrease in efficiency, boiler explosion) prevention of scale formation -softening of hard water -external treatment zeolite and demineralization - internal treatment- boiler compounds (phosphate, calgon, carbonate, colloidal) - caustic embrittlement -boiler corrosion-priming and foaming- desalination of brackish water –reverse osmosis.

**UNIT II ELECTROCHEMISTRY AND CORROSION****9**

Electrochemical cell - redox reaction, electrode potential- origin of electrode potential- oxidation potential- reduction potential, measurement and applications - electrochemical series and its significance - Nernst equation (derivation and problems). Corrosion- causes- factors- types- chemical, electrochemical corrosion (galvanic, differential aeration), corrosion control - material selection and design aspects - electrochemical protection – sacrificial anode method and impressed current cathodic method. Paints- constituents and function. Electroplating of Copper and electroless plating of nickel.

**UNIT III ENERGY SOURCES****9**

Introduction- nuclear energy- nuclear fission- controlled nuclear fission- nuclear fusion- differences between nuclear fission and fusion- nuclear chain reactions- nuclear reactor power generator- classification of nuclear reactor- light water reactor- breeder reactor- solar energy conversion- solar cells- wind energy. Batteries and fuel cells:Types of batteries- alkaline battery- lead storage battery- nickel-cadmium battery- lithium battery- fuel cell H<sub>2</sub> -O<sub>2</sub> fuel cell- applications.



**UNIT IV ENGINEERING MATERIALS****9**

Abrasives: definition, classification or types, grinding wheel, abrasive paper and cloth. Refractories: definition, characteristics, classification, properties – refractoriness and RUL, dimensional stability, thermal spalling, thermal expansion, porosity; Manufacture of alumina, magnesite and silicon carbide, Portland cement- manufacture and properties - setting and hardening of cement, special cement- waterproof and white cement–properties and uses. Glass - manufacture, types, properties and uses.

**UNIT V FUELS AND COMBUSTION****9**

Fuel: Introduction- classification of fuels- calorific value- higher and lower calorific values- coal-analysis of coal (proximate and ultimate)- carbonization- manufacture of metallurgical coke (Otto Hoffmann method) - petroleum- manufacture of synthetic petrol (Bergius process)- knocking-octane number - diesel oil- cetane number - natural gas- compressed natural gas(CNG)- liquefied petroleum gases(LPG)- producer gas- water gas. Power alcohol and bio diesel. Combustion of fuels: introduction- theoretical calculation of calorific value- calculation of stoichiometry of fuel and air ratio- ignition temperature- explosive range - flue gas analysis (ORSAT Method).

**TOTAL: 45 PERIODS****OUTCOMES:**

- The knowledge gained on engineering materials, fuels, energy sources and water treatment techniques will facilitate better understanding of engineering processes and applications for further learning.

**TEXT BOOKS:**

1. Vairam S, Kalyani P and SubaRamesh., “Engineering Chemistry”., Wiley India PvtLtd., New Delhi., 2011
2. DaraS.S, UmareS.S. “Engineering Chemistry”, S. Chand & Company Ltd., New Delhi , 2010

**REFERENCES:**

- 1 Kannan P. and Ravikrishnan A., “Engineering Chemistry”, Sri Krishna Hi-tech Publishing Company Pvt. Ltd. Chennai, 2009
2. AshimaSrivastava and Janhavi N N., “Concepts of Engineering Chemistry”, ACME Learning Private Limited., New Delhi., 2010.
3. RenuBapna and Renu Gupta., “Engineering Chemistry”, Macmillan India Publisher Ltd., 2010.
4. Pahari A and Chauhan B., “Engineering Chemistry”., Firewall Media., New Delhi., 2010

**GE6252****BASIC ELECTRICAL AND ELECTRONICS ENGINEERING****L T P C  
4 0 0 4****OBJECTIVES:**

- To explain the basic theorems used in Electrical circuits and the different components and function of electrical machines.
- To explain the fundamentals of semiconductor and applications.
- To explain the principles of digital electronics
- To impart knowledge of communication.

**UNIT I ELECTRICAL CIRCUITS & MEASUREMENTS****12**

Ohm’s Law – Kirchoff’s Laws – Steady State Solution of DC Circuits – Introduction to AC Circuits – Waveforms and RMS Value – Power and Power factor – Single Phase and Three Phase Balanced Circuits.

Operating Principles of Moving Coil and Moving Iron Instruments (Ammeters and Voltmeters), Dynamometer type Watt meters and Energy meters.

<b>UNIT II</b>	<b>ELECTRICAL MECHANICS</b>	<b>12</b>
Construction, Principle of Operation, Basic Equations and Applications of DC Generators, DC Motors, Single Phase Transformer, single phase induction Motor.		
<b>UNIT III</b>	<b>SEMICONDUCTOR DEVICES AND APPLICATIONS</b>	<b>12</b>
Characteristics of PN Junction Diode – Zener Effect – Zener Diode and its Characteristics – Half wave and Full wave Rectifiers – Voltage Regulation. Bipolar Junction Transistor – CB, CE, CC Configurations and Characteristics – Elementary Treatment of Small Signal Amplifier.		
<b>UNIT IV</b>	<b>DIGITAL ELECTRONICS</b>	<b>12</b>
Binary Number System – Logic Gates – Boolean Algebra – Half and Full Adders – Flip-Flops – Registers and Counters – A/D and D/A Conversion (single concepts)		
<b>UNIT V</b>	<b>FUNDAMENTALS OF COMMUNICATION ENGINEERING</b>	<b>12</b>
Types of Signals: Analog and Digital Signals – Modulation and Demodulation: Principles of Amplitude and Frequency Modulations. Communication Systems: Radio, TV, Fax, Microwave, Satellite and Optical Fibre (Block Diagram Approach only).		
		<b>TOTAL: 60 PERIODS</b>

**OUTCOMES:**

- ability to identify the electrical components explain the characteristics of electrical machines.
- ability to identify electronics components and use of them to design circuits.

**TEXT BOOKS:**

1. Mittle N., “Basic Electrical Engineering”, Tata McGraw Hill Edition, New Delhi, 1990.
2. Sedha R.S., “Applied Electronics”, S. Chand & Co., 2006.

**REFERENCES:**

1. Muthusubramanian R, Salivahanan S and Muraleedharan K A, “Basic Electrical, Electronics and Computer Engineering”, Tata McGraw Hill, Second Edition, 2006.
2. Nagsarkar T K and Sukhija M S, “Basics of Electrical Engineering”, Oxford press 2005.
3. Mehta V K, “Principles of Electronics”, S.Chand & Company Ltd, 1994.
4. Mahmood Nahvi and Joseph A. Edminister, “Electric Circuits”, Schaum’ Outline Series, McGraw Hill, 2002.
5. Premkumar N, “Basic Electrical Engineering”, Anuradha Publishers, 2003.

**GE6253**

**ENGINEERING MECHANICS**

**L T P C**  
**3 1 0 4**

**OBJECTIVES:**

- To develop capacity to predict the effect of force and motion in the course of carrying out the design functions of engineering.

<b>UNIT I</b>	<b>BASICS AND STATICS OF PARTICLES</b>	<b>12</b>
Introduction – Units and Dimensions – Laws of Mechanics – Lami’s theorem, Parallelogram and triangular Law of forces — Vectorial representation of forces – Vector operations of forces - additions, subtraction, dot product, cross product – Coplanar Forces – rectangular components – Equilibrium of a particle – Forces in space – Equilibrium of a particle in space – Equivalent systems of forces – Principle of transmissibility .		

**UNIT II EQUILIBRIUM OF RIGID BODIES 12**

Free body diagram – Types of supports –Action and reaction forces –stable equilibrium – Moments and Couples – Moment of a force about a point and about an axis – Vectorial representation of moments and couples – Scalar components of a moment – Varignon’s theorem – Single equivalent force -Equilibrium of Rigid bodies in two dimensions – Equilibrium of Rigid bodies in three dimensions

**UNIT III PROPERTIES OF SURFACES AND SOLIDS 12**

Centroids and centre of mass– Centroids of lines and areas - Rectangular, circular, triangular areas by integration – T section, I section, - Angle section, Hollow section by using standard formula –Theorems of Pappus - Area moments of inertia of plane areas – Rectangular, circular, triangular areas by integration – T section, I section, Angle section, Hollow section by using standard formula – Parallel axis theorem and perpendicular axis theorem –Principal moments of inertia of plane areas – Principal axes of inertia-Mass moment of inertia –mass moment of inertia for prismatic, cylindrical and spherical solids from first principle – Relation to area moments of inertia.

**UNIT IV DYNAMICS OF PARTICLES 12**

Displacements, Velocity and acceleration, their relationship – Relative motion – Curvilinear motion - Newton’s laws of motion – Work Energy Equation– Impulse and Momentum – Impact of elastic bodies.

**UNIT V FRICTION AND ELEMENTS OF RIGID BODY DYNAMICS 12**

Friction force – Laws of sliding friction – equilibrium analysis of simple systems with sliding friction – wedge friction-. Rolling resistance -Translation and Rotation of Rigid Bodies – Velocity and acceleration – General Plane motion of simple rigid bodies such as cylinder, disc/wheel and sphere.

**TOTAL : 60 PERIODS**

**OUTCOMES:**

- ability to explain the differential principles applies to solve engineering problems dealing with force, displacement, velocity and acceleration.
- ability to analyse the forces in any structures.
- ability to solve rigid body subjected to dynamic forces.

**TEXT BOOKS:**

1. Beer, F.P and Johnston Jr. E.R., “Vector Mechanics for Engineers (In SI Units): Statics and Dynamics”, 8<sup>th</sup> Edition, Tata McGraw-Hill Publishing company, New Delhi (2004).
2. Vela Murali, “Engineering Mechanics”, Oxford University Press (2010)

**REFERENCES:**

1. Hibbeler, R.C and Ashok Gupta, “Engineering Mechanics: Statics and Dynamics”, 11<sup>th</sup> Edition, Pearson Education 2010.
2. Irving H. Shames and Krishna Mohana Rao. G., “Engineering Mechanics – Statics and Dynamics”, 4<sup>th</sup> Edition, Pearson Education 2006.
3. Meriam J.L. and Kraige L.G., “ Engineering Mechanics- Statics - Volume 1, Dynamics- Volume 2”, Third Edition, John Wiley & Sons,1993.
4. Rajasekaran S and Sankarasubramanian G., “Engineering Mechanics Statics and Dynamics”, 3<sup>rd</sup> Edition, Vikas Publishing House Pvt. Ltd., 2005.
5. Bhavikatti, S.S and Rajashekarappa, K.G., “Engineering Mechanics”, New Age International (P) Limited Publishers, 1998.
6. Kumar, K.L., “Engineering Mechanics”, 3<sup>rd</sup> Revised Edition, Tata McGraw-Hill Publishing company, New Delhi 2008.

**OBJECTIVES:**

- To develop skill to use software to create 2D and 3D models.

**List of Exercises using software capable of Drafting and Modeling**

- Study of capabilities of software for Drafting and Modeling – Coordinate systems (absolute, relative, polar, etc.) – Creation of simple figures like polygon and general multi-line figures.
- Drawing of a Title Block with necessary text and projection symbol.
- Drawing of curves like parabola, spiral, involute using Bspline or cubic spline.
- Drawing of front view and top view of simple solids like prism, pyramid, cylinder, cone, etc, and dimensioning.
- Drawing front view, top view and side view of objects from the given pictorial views (eg. V-block, Base of a mixie, Simple stool, Objects with hole and curves).
- Drawing of a plan of residential building ( Two bed rooms, kitchen, hall, etc.)
- Drawing of a simple steel truss.
- Drawing sectional views of prism, pyramid, cylinder, cone, etc,
- Drawing isometric projection of simple objects.
- Creation of 3-D models of simple objects and obtaining 2-D multi-view drawings from 3-D model.

Note: Plotting of drawings must be made for each exercise and attached to the records written by students.

**TOTAL: 45 PERIODS****OUTCOMES:**

- ability to use the software packers for drafting and modeling
- ability to create 2D and 3D models of Engineering Components

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:**

Sl.No	Description of Equipment	Quantity
1.	Pentium IV computer or better hardware, with suitable graphics facility	30 No.
2.	Licensed software for Drafting and Modeling.	30 Licenses
3.	Laser Printer or Plotter to print / plot drawings	2 No.

**PHYSICS LABORATORY – II****OBJECTIVES:**

- To introduce different experiments to test basic understanding of physics concepts applied in optics, thermal physics and properties of matter.

**LIST OF EXPERIMENTS  
(Any FIVE Experiments)**

- Determination of Young's modulus by uniform bending method
- Determination of band gap of a semiconductor
- Determination of Coefficient of viscosity of a liquid –Poiseuille's method
- Determination of Dispersive power of a prism - Spectrometer
- Determination of thickness of a thin wire – Air wedge method

- Determination of Rigidity modulus – Torsion pendulum

**OUTCOMES:**

- The students will have the ability to test materials by using their knowledge of applied physics principles in optics and properties of matter.

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:**

- Traveling microscope, meter scale, Knife edge, weights
- Band gap experimental set up
- Burette, Capillary tube, rubber tube, stop clock, beaker and weighing balance
- spectrometer, prism, sodium vapour lamp.
- Air-wedge experimental set up.
- Torsion pendulum set up.  
(vernier Caliper, Screw gauge, reading lens are required for most of the experiments)

**CHEMISTRY LABORATORY - II****OBJECTIVES:**

- To make the student acquire practical skills in the wet chemical and instrumental methods for quantitative estimation of hardness, alkalinity, metal ion content, corrosion in metals and cement analysis.

**LIST OF EXPERIMENTS****(Any FIVE Experiments)**

- Determination of alkalinity in water sample
- Determination of total, temporary & permanent hardness of water by EDTA method
- Estimation of copper content of the given solution by EDTA method
- Estimation of iron content of the given solution using potentiometer
- Estimation of sodium present in water using flame photometer
- Corrosion experiment – weight loss method
- Conductometric precipitation titration using  $\text{BaCl}_2$  and  $\text{Na}_2\text{SO}_4$
- Determination of CaO in Cement.

**TOTAL: 30 PERIODS****OUTCOMES:**

- The students will be conversant with hands-on knowledge in the quantitative chemical analysis of water quality related parameters, corrosion measurement and cement analysis.

**REFERENCES:**

- Daniel R. Palleros, "Experimental organic chemistry" John Wiley & Sons, Inc., New York, 2001.
  - Furniss B.S. Hannaford A.J, Smith P.W.G and Tatchel A.R., "Vogel's Textbook of practical organic chemistry, LBS Singapore ,1994.
  - Jeffery G.H, Bassett J., Mendham J. and Denny R.C., "Vogel's Text book of quantitative analysis chemical analysis", ELBS 5th Edn. Longman, Singapore publishers, Singapore, 1996.
  - Kolthoff I.M. and Sandell E.B. et al. Quantitative chemical analysis, McMillan, Madras 1980
- Laboratory classes on alternate weeks for Physics and Chemistry.**

## LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

1. Potentiometer	-	5 Nos
2. Flame photo meter	-	5 Nos
3. Weighing Balance	-	5 Nos
4. Conductivity meter	-	5 Nos

**Common Apparatus : Pipette, Burette, conical flask, porcelain tile, dropper (30 Nos each)**

**GE6263                      COMPUTER PROGRAMMING LABORATORY                      L T P C**  
**0 1 2 2**

### OBJECTIVES:

**The Students should be made to**

- Be exposed to Unix shell commands
- Be familiar with an editor on Unix
- Learn to program in Shell script
- Learn to write C programme for Unix platform

### LIST OF EXPERIMENTS

<b>1. UNIX COMMANDS</b>	<b>15</b>
Study of Unix OS - Basic Shell Commands - Unix Editor	
<b>2. SHELL PROGRAMMING</b>	<b>15</b>
Simple Shell program - Conditional Statements - Testing and Loops	
<b>3. C PROGRAMMING ON UNIX</b>	<b>15</b>
Dynamic Storage Allocation-Pointers-Functions-File Handling	

**TOTAL: 45 PERIODS**

### OUTCOMES:

At the end of the course the students should be able to:

- Use Shell commands
- Design of Implement Unix shell scripts
- Write and execute C programs on Unix

### HARDWARE / SOFTWARE REQUIREMENTS FOR A BATCH OF 30 STUDENTS

#### Hardware

- 1 UNIX Clone Server
- 3 3 Nodes (thin client or PCs)
- Printer – 3 Nos.

#### Software

- OS – UNIX Clone (33 user license or License free Linux)
- Compiler - C

**MA6468                      PROBABILITY AND STATISTICS                      L T P C**

**OBJECTIVES:**

- This course aims at providing the required skill to apply the statistical tools in engineering problems.

**UNIT I          RANDOM VARIABLES****9 + 3**

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**

Joint distributions – Marginal and conditional distributions – Covariance – Correlation and Linear regression – Transformation of random variables – Central limit theorem (for independent and identically distributed random variables).

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

Sampling distributions - Estimation of parameters - Statistical hypothesis - Large sample test based on Normal distribution for single mean and difference of means -Tests based on t, Chi-square and F distributions for mean, variance and proportion - Contingency table (test for independent) - Goodness of fit.

**UNIT IV          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 V          STATISTICAL QUALITY CONTROL****9 + 3**

Control charts for measurements (X and R charts) – Control charts for attributes (p, c and np charts) – Tolerance limits - Acceptance sampling.

**TOTAL (L:45+T:15): 60 PERIODS****OUTCOMES:**

- The students will have a fundamental knowledge of the concepts of probability. Have knowledge of standard distributions which can describe real life phenomenon. Have the notion of sampling distributions and statistical techniques used in engineering and management problems.

**TEXT BOOKS:**

1. Milton. J. S. and Arnold. J.C., "Introduction to Probability and Statistics", Tata McGraw Hill, 4th Edition, 2007.
2. Johnson. R.A. and Gupta. C.B., "Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 7th Edition, 2007.
3. Papoulis. A and Unnikrishnapillai. S., "Probability, Random Variables and Stochastic Processes" Mc-Graw Hill Education India , 4th Edition, New Delhi , 2010.

**REFERENCES:**

1. Devore. J.L., "Probability and Statistics for Engineering and the Sciences", Cengage Learning, New Delhi, 8th Edition, 2012.
2. Walpole. R.E., Myers. R.H., Myers. S.L. and Ye. K., "Probability and Statistics for Engineers and Scientists", Pearson Education, Asia , 8th Edition, 2007.
3. Ross, S.M., "Introduction to Probability and Statistics for Engineers and Scientists", 3rd Edition, Elsevier, 2004.
4. Spiegel. M.R., Schiller. J. and Srinivasan. R.A., "Schaum's Outline of Theory and Problems of Probability and Statistics", Tata McGraw Hill Edition, 2004.

**OBJECTIVES:**

To the study of nature and the facts about environment

- To find and implement scientific, technological, economic and political solutions to environmental problems.
- To study the interrelationship between living organism and environment.
- To appreciate the importance of environment by assessing its impact on the human world; envision the surrounding environment, its functions and its value.
- To study the dynamic processes and understand the features of the earth's interior and surface.
- To study the integrated themes and biodiversity, natural resources, pollution control and waste management.

**UNIT I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY****12**

Definition, scope and importance of Risk and hazards; Chemical hazards, Physical hazards, Biological hazards in the environment – concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers-Oxygen cycle and Nitrogen cycle – energy flow in the ecosystem – ecological succession processes – Introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) – Introduction to biodiversity definition: genetic, species and ecosystem diversity – biogeographical classification of India – value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – Biodiversity at global, national and local levels – 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 conservation of biodiversity. Field study of common plants, insects, birds  
Field study of simple ecosystems – pond, river, hill slopes, etc.

**UNIT II ENVIRONMENTAL POLLUTION****10**

Definition – causes, effects and control measures of: (a) Air pollution (Atmospheric chemistry-Chemical composition of the atmosphere; Chemical and photochemical reactions in the atmosphere - formation of smog, PAN, acid rain, oxygen and ozone chemistry;- Mitigation procedures- Control of particulate and gaseous emission, Control of SO<sub>2</sub>, NO<sub>x</sub>, CO and HC) (b) Water pollution : Physical and chemical properties of terrestrial and marine water and their environmental significance; Water quality parameters – physical, chemical and biological; absorption of heavy metals - Water treatment processes. (c) Soil pollution - soil waste management: causes, effects and control measures of municipal solid wastes – (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards–role of an individual in prevention of pollution – pollution case studies – Field study of local polluted site – Urban / Rural / Industrial / Agricultural.

**UNIT III NATURAL RESOURCES****10**

Forest resources: Use and over-exploitation, deforestation, case studies- timber extraction, mining, dams and their effects on forests and tribal people – Water resources: Use and overutilization of surface and ground water, dams-benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. Energy Conversion processes – Biogas – production and uses, anaerobic digestion; case studies – Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification – role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles. Introduction to Environmental Biochemistry: Proteins – Biochemical degradation of pollutants, Bioconversion of pollutants.  
Field study of local area to document environmental assets – river / forest / grassland / hill /



mountain.

**UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT 7**

From unsustainable to sustainable development – urban problems related to energy – water conservation, rain water harvesting, watershed management – resettlement and rehabilitation of people; its problems and concerns, case studies – role of non-governmental organization- environmental ethics: Issues and possible solutions – 12 Principles of green chemistry- nuclear accidents and holocaust, case studies. – wasteland reclamation – consumerism and waste products – environment production act – Air act – Water act – Wildlife protection act – Forest conservation act –The Biomedical Waste (Management and Handling) Rules; 1998 and amendments- scheme of labeling of environmentally friendly products (Ecomark). enforcement machinery involved in environmental legislation- central and state pollution control boards- disaster management: floods, earthquake, cyclone and landslides. Public awareness.

**UNIT V HUMAN POPULATION AND THE ENVIRONMENT 6**

Population growth, variation among nations – population explosion – family welfare programme – environment and human health – human rights – value education – HIV / AIDS – women and child welfare –Environmental impact analysis (EIA)- -GIS-remote sensing-role of information technology in environment and human health – Case studies.

**TOTAL : 45 PERIODS**

**OUTCOMES:**

Environmental Pollution or problems cannot be solved by mere laws. Public participation is an important aspect which serves the environmental Protection. One will obtain knowledge on the following after completing the course.

- Public awareness of environmental is at infant stage.
- Ignorance and incomplete knowledge has lead to misconceptions
- Development and improvement in std. of living has lead to serious environmental disasters

**TEXT BOOKS:**

1. Gilbert M.Masters, 'Introduction to Environmental Engineering and Science', 2nd edition, Pearson Education (2004).
2. Benny Joseph, 'Environmental Science and Engineering', Tata McGraw-Hill, New Delhi, (2006).

**REFERENCES:**

1. R.K. Trivedi, 'Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards', Vol. I and II, Enviro Media.
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)

**TC6303**

**ORGANIC CHEMISTRY**

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

**OBJECTIVE:**

To impart knowledge on various reaction mechanism, preparation of organic compounds and their properties. This will be a precursor for the study on Chemical Reaction Engineering.

**UNIT I ALIPHATIC HYDROCARBONS AND ALCOHOLS 9**

Alkanes – General methods of preparation – Physical and chemical properties – Alkenes – General methods of preparation – Physical and chemical properties – Markovnikov's rule – Peroxide effect – Bayer's test – Alkynes – General methods of preparation and properties monohydric alcohols – Saytzeff rule – Methods of distinguishing the three classes of alcohols – Lucas test – Dichromate test.

**UNIT II 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.

**UNIT III CARBOHYDRATES 9**

Classification of carbohydrates – Monosaccharides – Reactions of glucose and fructose – Open chain and cyclic structures of glucose and fructose – Mutarotation – Epimerization – Killiani-Fisher synthesis – Ruff degradation – Conversion of aldoses to ketoses and ketoses to aldoses – Disaccharides – Properties and structure of sucrose – Polysaccharides – Properties and structure of starch and cellulose – Derivatives of cellulose – Carboxy methyl cellulose and gun cotton.

**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 DYES AND DYEING 9**

Colour and constitution – Synthesis – Azodyes – Methyl orange – Methyl red and congo red – Triphenylmethane dyes – Malachite green – Para-rosaniline – Alizarin – Eosin – Introduction to natural and reactive dyes.

**TOTAL : 45 PERIODS**

**OUTCOMES:**

At the end of this course, the student will be able to

- Identify what distinguishes a strong and weak nucleophile and recall the rules of reactions
- Analyzes a list of compounds and determines their reactivity.

**TEXT BOOKS:**

1. Morrison R.T. and Boyd R.N., "Organic chemistry", 6th Edition, Prentice Hall of India (P) Ltd., 2003.
2. Arun Bahl and Bahl B.S., "Advanced Organic Chemistry", 16th Edition, S.Chand and Company Ltd., 2002.

**REFERENCES:**

1. March J., "March's Advanced Organic Chemistry: Reactions, Mechanisms, and Structure", 5th Edition, John Wiley, 2001.
2. Finar I.L., "Organic chemistry" Vol-I, 6th Edition, Pearson Education, 2002.
3. Sharma B.K., "Industrial Chemistry", 12th Edition, Goel Publishing house, 2001.

**TT6302**

**POLYMER SCIENCE**

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

**OBJECTIVES:**

To enable the students to learn about the

- Various polymerisation techniques
- Fibre forming polymer characteristics and evaluation techniques
- Knowledge on processing of regenerated fibres
- Need of various additives in polymer processing.

#### **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. Polycondensation 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 Thermomechanical methods. Determination molecular weights – Weight average – Light scattering, Number average – End group analysis, Viscosity average – Ubbelohde viscometer. Thermal characterization – TGA and DSC.

#### **UNIT IV REGENERATED CELLULOSE AND PROTEIN**

**9**

Manufacture of Viscose, Cuprammonium and Acetate rayon - Modified high wet modulus – Polynosic, Lyocell – Super high wet modulus. Regenerated proteins.

#### **UNIT V POLYMER PROCESSING AND REUSE OF POLYMERS**

**9**

Additives of Polymers – Fillers, Plasticizers, Anti-oxidants, UV Stabilizers and Coloring agents. Polymer processing methods – Moulding, Extrusion, Calendering and Film cating. Recovery from Polyester and Nylon. Reuse of acrylic and polypropylene wastes.

**TOTAL : 45 PERIODS**

#### **OUTCOMES:**

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

- Understand the various techniques in polymerisation
- Understand Synthesis of few important polymers in textile
- Correlate the physical properties of polymer and additives with the microstructure and property of polymer.

#### **TEXTBOOKS:**

1. Gowrikar V. R. , Viswanathan N.V. and Jayadev Sreedhar, “Polymer Science”, New Age Publication, New Delhi 2003.
2. Gupta V. B. and Kothari V. K. , “Manufacture Fibre Technology”, Chapman and Hall Publication, UK 1997.
3. Billmayer F. M., “ Text Book of Polymer science”, Wiley Inter Science, New York, 2002.

#### **REFERENCES:**

1. Odion G., “Principles of Polymerization”, John Wiley, UK, 2002.
2. Woodings C., “Regenerated Cellulose Fibres”, Woodhead Publishing, UK, 2000.

**TC6301**

**STRUCTURE AND PROPERTIES OF FIBRES**

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

#### **OBJECTIVES**

- To provide knowledge on classification of fibres



**REFERENCES:**

1. Kothari V.K., Progress in Textiles: Science & Technology. Vol. 2, IAFL Publications, 2000.
2. Mishra, S.P., Fibre Science & Technology, New Age International Publishers, 2000.
3. Meredith. R and Hearle, J.W.S., "Physical Methods of Investigation of Textiles", Wiley Publication, New York, 1989.

**TC6302****TECHNOLOGY OF YARN MANUFACTURE****L T P C  
3 1 0 4****OBJECTIVES:**

- To expose the students to the numbering system used to specify textile yarns
- To enable the students to understand the processes involved in the production of yarn from fibres
- To enable the students to understand the machinery used for the production of yarns using short staple spinning system

**UNIT I GINNING AND BLOWROOM****9**

Yarn numbering systems. Objectives of ginning, Study of working of different gins – Knife roller gin, Saw gin & Macarthy gin. Objectives of blow room. Principle and working of Opening, Cleaning, Mixing and Blending machines. Settings and speeds. Sequence of machines in modern blow room line. Mechanism of Lap feed and Chute feed system.

**UNIT II CARDING AND DRAWFRAME****9**

Objectives of carding. Basics of Opening, Cleaning and fibre individualization. Study of working of SHP & HP cards. Card settings and speeds. Card clothing. Basic principles of doubling and drafting. Description of working of various drafting systems. Working of draw frame machines. Autolevellers in drawframe.

**UNIT III COMBER AND SPEEDFRAME****9**

Requirement and objectives of comber preparatory processes. Methods of lap preparation. Objectives and principles of combing. Working of comber – sequence and timing of operations in combing. Types of feeding. Degree of combing. Comber settings. Objectives of speed frame. Principle of working of speed frame. Differences between bobbin lead / flyer lead roving processes. Mechanism of winding and bobbin building. Settings and speeds.

**UNIT IV RING FRAME****9**

Principle of ring spinning. Detailed study of modern ring frame. Drafting system, Types of top roller loading systems - Functions of yarn guide, balloon control ring, separators, rings and travellers. Spindles – spindle size, spindle drives. Traveller lag. Cop building – ring rail movements, builder motion, doffing procedure. Two-for-one twister. Condensed yarn spinning system – Different methods of condensed yarn systems, condensed yarn properties vis-à-vis conventional ring-spun yarn properties.

**UNIT V OTHER SPINNING SYSTEMS****9**

Principles of yarn manufacture, yarn characteristics and applications of Rotor Spinning, Friction Spinning, Air-jet spinning, Wrap spinning, Core yarn spinning and Self-twist spinning, Twistless spinning.

**TOTAL (L : 45 + T : 15) : 60 PERIODS****OUTCOMES:**

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

- Calculate the yarn numbering by different systems

- Understand the processes involved in the production of yarn using short staple spinning system
- Understand the details of machinery used for the production of yarn

#### **TEXT BOOKS:**

1. Klein W., Vol. 1-3, "The Technology of Short Staple Spinning", "A Practical Guide to Opening & Carding" and "A Practical Guide to Combing, Drawing, and Roving frame", The Textile Institute, Manchester, U.K., 1998.
2. Chattopadhyay R. (Ed), Advances in Technology of Yarn Production, NCUTE, IIT Delhi, 2002.
3. Klein W., Vol.4 -5, "A Practical Guide to Ring Spinning, 1987" and "New Spinning Systems, 1993" The Textile Institute, Manchester, 1987.
4. Gowda R.V.M, "New Spinning Systems", NCUTE, IIT Delhi, 2003.

#### **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 Delhi 1998.
4. Duraiswamy I, Chellamani P & Pavendhan A., "Cotton Ginning" Textile Progress, The Textile Institute, Manchester, U.K., 1993.
5. Lord P. R., Yarn Production: Science Technology and Economics", The Textile Institute, Manchester, U.K., 1999.

**TC6311**

**TEXTILE CHEMICALS ANALYSIS LABORATORY**

**L T P C  
0 0 3 2**

#### **OBJECTIVES:**

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

#### **LIST OF EXPERIMENTS**

1. Estimation of the Efficiency of the wetting agent.
2. Evaluation of the oxidizing agent.
3. Evaluation of the reducing agent.
4. Evaluation of the dispersing agent.
5. Evaluation of the Optical Brightening agent.
6. Analysis of oils.
7. Evaluation of the inorganic substances in Textile processing.
8. Identification of dye powder.
9. Identification of the dye in the dyed fabric
10. Estimation of percentage purity of the dye solution.
11. Evaluation of the finishing chemicals

**TOTAL : 45 PERIODS**

#### **OUTCOMES:**

On completion of this course, the students would be able to estimate different types of chemicals used for wet processing of textile materials. They would also be able to identify the dyes and estimate purity of dye solution.

#### **LIST OF EQUIPMENTS 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. Computer color Matching instrument – 1 No.
7. Glassware – Required quantity

**TC6312**

**FIBRE ANALYTICAL LABORATORY**

**L T P C**  
**0 0 3 2**

**OBJECTIVES:**

To practice the students to

- Identify textile fibres by different tests and
- Measure important properties of fibres

**LIST OF EXPERIMENTS**

1. Identification of longitudinal & cross sectional view of cellulosic fibers
2. Identification of longitudinal & cross sectional view of Protein fibers
3. Identification of longitudinal & cross sectional view of Synthetic fibers
4. Identification of burning behavior of Cellulosic fibres
5. Identification of burning behavior of Protein fibers
6. Identification of burning behavior of Synthetic fibers
7. Determination of Moisture Regain of Cellulosic fibres
8. Determination of Moisture Regain of Protein fibres
9. Determination of Moisture Regain of Synthetic fibres
10. Determination of Density of Fibres
11. Identification of Cellulosic fibre by Staining Test
12. Identification of Protein fibre by Staining Test
13. Identification of Synthetic fibre by Staining Test
14. Identification of Cellulosic fibres by solvent method
15. Identification of Protein fibres by solvent method
16. Identification of Synthetic fibres by solvent method

**TOTAL: 45 PERIODS**

**OUTCOMES:**

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

- Identify different types of textile fibres based on structure, density, staining, burning and dissolution in solvents
- Measure the moisture regain property of textile fibres

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

1. Weighing Balance – 1 No.
2. Projection Microscope – 1 No.
3. Conditioning Oven – 1 No.
4. Moisture Meter – 1 No.
5. Density Gradient column – 1 No.
6. Bunsen Burner – 1 No.
7. Stain Tester – 1 No.
8. Glass ware – Required quantity

**OBJECTIVES:**

To enable learners to,

- Develop their communicative competence in English with specific reference to speaking and listening
- Enhance their ability to communicate effectively in interviews.
- Strengthen their prospects of success in competitive examinations.

**UNIT I LISTENING AND SPEAKING SKILLS 12**

Conversational skills (formal and informal)- group discussion- making effective presentations using computers, listening/watching interviews conversations, documentaries. Listening to lectures, discussions from TV/ Radio/ Podcast.

**UNIT II READING AND WRITING SKILLS 12**

Reading different genres of tests ranging from newspapers to creative writing. Writing job applications- cover letter- resume- emails- letters- memos- reports. Writing abstracts- summaries- interpreting visual texts.

**UNIT III ENGLISH FOR NATIONAL AND INTERNATIONAL EXAMINATIONS AND PLACEMENTS 12**

International English Language Testing System (IELTS) - Test of English as a Foreign Language (TOEFL) - Civil Service(Language related)- Verbal Ability.

**UNIT IV INTERVIEW SKILLS 12**

Different types of Interview format- answering questions- offering information- mock interviews-body language( paralinguistic features)- articulation of sounds- intonation.

**UNIT V SOFT SKILLS 12**

**Motivation- emotional intelligence**-Multiple intelligences- emotional intelligence- managing changes-time management-stress management-leadership traits-team work- career planning - intercultural communication- creative and critical thinking

**TOTAL: 60 PERIODS**

**Teaching Methods:**

1. To be totally learner-centric with minimum teacher intervention as the course revolves around practice.
2. Suitable audio/video samples from Podcast/YouTube to be used for illustrative purposes.
3. Portfolio approach for writing to be followed. Learners are to be encouraged to blog, tweet, text and email employing appropriate language.
4. GD/Interview/Role Play/Debate could be conducted off the laboratory (in a regular classroom) but learners are to be exposed to telephonic interview and video conferencing.
5. Learners are to be assigned to read/write/listen/view materials outside the classroom as well for gaining proficiency and better participation in the class.

**Lab Infrastructure:**

S. No.	Description of Equipment (minimum configuration)	Qty Required
1	<b>Server</b>	1 No.
	• PIV System	
	• 1 GB RAM / 40 GB HDD	
	• OS: Win 2000 server	
	• Audio card with headphones	
• JRE 1.3		



2	<b>Client Systems</b>	60 Nos.
	• PIII or above	
	• 256 or 512 MB RAM / 40 GB HDD	
	• OS: Win 2000	
	• Audio card with headphones	
	• JRE 1.3	
3	Handicam	1 No.
4	Television 46"	1 No.
5	Collar mike	1 No.
6	Cordless mike	1 No.
7	Audio Mixer	1 No.
8	DVD recorder/player	1 No.
9	LCD Projector with MP3/CD/DVD provision for Audio/video facility	1 No.

### Evaluation:

#### Internal: 20 marks

Record maintenance: Students should write a report on a regular basis on the activities conducted, focusing on the details such as the description of the activity, ideas emerged, learning outcomes and so on. At the end of the semester records can be evaluated out of 20 marks.

#### External: 80 marks

Online Test	- 35 marks
Interview	- 15 marks
Presentation	- 15 marks
Group Discussion	- 15 marks

#### Note on Internal and External Evaluation:

1. Interview – mock interview can be conducted on one-on-one basis.
2. Speaking – example for role play:
  - a. Marketing engineer convincing a customer to buy his product.
  - b. Telephonic conversation- fixing an official appointment / placing an order / enquiring and so on.
3. Presentation – should be extempore on simple topics.
4. Discussion – topics of different kinds; general topics, and case studies.

#### OUTCOMES:

##### At the end of the course, learners should be able to

- Take international examination such as IELTS and TOEFL
- Make presentations and Participate in Group Discussions.
- Successfully answer questions in interviews.

#### REFERENCES:

1. **Business English Certificate Materials**, Cambridge University Press.
2. **Graded Examinations in Spoken English and Spoken English for Work** downloadable materials from Trinity College, London.
3. **International English Language Testing System** Practice Tests, Cambridge University Press.
4. Interactive Multimedia Programs on **Managing Time and Stress**.
5. **Personality Development** (CD-ROM), Times Multimedia, Mumbai.
6. Robert M Sherfield and et al. **“Developing Soft Skills”** 4th edition, New Delhi: Pearson Education, 2009.

**Web Sources:**

<http://www.slideshare.net/rohitjsh/presentation-on-group-discussion>

[http://www.washington.edu/doi/TeamN/present\\_tips.html](http://www.washington.edu/doi/TeamN/present_tips.html)

<http://www.oxforddictionaries.com/words/writing-job-applications>

<http://www.kent.ac.uk/careers/cv/coveringletters.htm>

[http://www.mindtools.com/pages/article/newCDV\\_34.htm](http://www.mindtools.com/pages/article/newCDV_34.htm)

**MA6459****NUMERICAL METHODS****L T P C****3 1 0 4****OBJECTIVE:**

This course aims at providing the necessary basic concepts of a few numerical methods and give procedures for solving numerically different kinds of problems occurring in engineering and technology.

**UNIT I SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS 10+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 - Matrix Inversion by Gauss Jordan method - Eigenvalues of a matrix by Power method.

**UNIT II INTERPOLATION AND APPROXIMATION 8+3**

Interpolation with unequal intervals - Lagrange's interpolation – Newton's divided difference interpolation – Cubic Splines - Interpolation with equal intervals - Newton's forward and backward difference formulae.

**UNIT III NUMERICAL DIFFERENTIATION AND INTEGRATION 9+3**

Approximation of derivatives using interpolation polynomials - Numerical integration using Trapezoidal, Simpson's 1/3 rule – Romberg's method - Two point and three point Gaussian quadrature formulae – Evaluation of double integrals by Trapezoidal and Simpson's 1/3 rules.

**UNIT IV INITIAL VALUE PROBLEMS FOR 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 equations - Multi step methods - Milne's and Adams-Bashforth predictor corrector methods for solving first order equations.

**UNIT V BOUNDARY VALUE PROBLEMS IN ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS 9+3**

Finite difference methods for solving two-point linear boundary value problems - Finite difference techniques for the solution of two dimensional Laplace's and Poisson's equations on rectangular domain – One dimensional heat flow equation by explicit and implicit (Crank Nicholson) methods – One dimensional wave equation by explicit method.

**TOTAL (L:45+T:15): 60 PERIODS****OUTCOME:**

It helps the students to have a clear perception of the power of numerical techniques, ideas and would be able to demonstrate the applications of these techniques to problems drawn from industry, management and other engineering fields.





- Design wet processing techniques such as singeing, desizing, mercerizing, scouring and bleaching of different textile materials at desired levels.
- Understand the process control of pre treatment processes

#### **TEXTBOOKS:**

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.
3. Charles Tomasno, Chemistry and Technology of fabric Preparation and Finishing, North Carolina State University, USA, 1992

#### **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

**TC6403**

**PRINCIPLES & THEORY OF DYEING**

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

#### **OBJECTIVES**

- 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., Effect of temp on reaction rate, Steady state principle. 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 – EMF and its measurement – 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 – Description of monolayer technique and continuous variable methods for the identification of dye – fibre bonds. Substantivity and affinity of dyes with textile materials. Thermodynamic derivations of affinity equations.

**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. Equilibrium absorption and diffusion co-efficient of dye molecules. Derivation of William Landed Ferry (WLF) equation and its significances on textile dyeing. Concept of free volume and solubility parameter. Idea about partition co-efficient.

**TOTAL : 45 PERIODS****OUTCOMES:**

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

- Explain the mechanics of dying
- Explain the factors influencing dyeing
- Work in the dye houses of textile processing industry

**TEXTBOOKS:**

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

**TC6404****PHYSICAL TESTING OF TEXTILE MATERIALS****L T P C  
3 0 0 3****OBJECTIVES:**

- To enable the students to understand the principles of equipments used for testing of textile fibres, yarns and fabrics
- To enable the students to understand the method of testing of textile fibres, yarns and fabrics
- To expose the students the method of applying statistical techniques for interpreting the data

**UNIT I INTRODUCTION****9**

Definition of quality – Types of quality – Quality control - Quality assurance – Quality system. Reasons for quality evaluation - Standardisation of testing. Sampling - Terms used in sampling. Fibre sampling from bulk, Fibre sampling from combed slivers, roving and yarn. Yarn sampling, Fabric sampling.

**UNIT II STATISTICAL EVALUATION****9**

Introduction to Statistical methods. Measures of central tendency – Arithmetic mean, Median, Mode. Measures of dispersion or Scatter – Range, Mean deviation, Standard deviation, Co-efficient of variation. Types of significance tests. Determination of number of tests. Types of error, Sources of error. Repeatability, Reproducibility. Significant figures.

**UNIT III FIBRE TESTS****9**

Moisture Terminology- Determination of relative humidity, moisture content and moisture regain in fibres. Measurement of fibre length and its importance. Measurement of fibre fineness and its importance. Measurement of Fibre Maturity. Tensile Testing Terminology – Factors influencing the results of tensile tests - Measurement of fibre strength. Fibre Quality - Measurement of Trash content. Neps in cotton. Principles of various advanced fibre testing instruments – High Volume Instrument & Advanced Fibre Information System.

**UNIT IV YARN TESTS****9**

Yarn Count, Crimp, Twist, Importance of twist - Strength, Factors affecting tensile testing - Tensile Testing of Yarn at High Speeds – Uster Tensojet, Lenzing Speedy, Textechno's Statimat – Ballistic Principle - Evenness, Hairiness, Yarn Bulk, Yarn Friction and Yarn Abrasion. Electronic Inspection Board.

**UNIT V FABRIC TESTS****9**

Fabric Strength - Tensile strength, Tear strength, Bursting strength, Seam strength. Dimensional stability- Serviceability – Snagging, Pilling, Abrasion resistance. Comfort – Thermal comfort, Moisture transport, Sensorial comfort, Water absorption, Water repellency - Colour fastness testing- Objective evaluation of fabric handle – Kawabata system, FAST.

**TOTAL : 45 PERIODS****OUTCOMES:**

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

- Explain the method of testing textile fibres, yarns and fabrics
- Analyze and interpret the results from testing equipments
- Apply statistical techniques for analyzing the test results.

**TEXTBOOKS:**

1. Booth, J.E, Textile Testing, Butterworth Heinemann Ltd., U.K, 1996
2. Kothari, V.K,(Ed), Testing and Quality Management, Vol.1, IAFL Publications, New Delhi, 1999.

**REFERENCES:**

1. Saville, B. P, Physical Testing of Textiles, Woodhead Publishing Ltd., England,1999.
2. Basu, A, Textile Testing - Fibre, Yarn and Fabric, SITRA, Coimbatore, 2001.
3. Koushik, C.V, Textile Testing-Fibre & Yarn Testing, NCUTE, New Delhi, 2004

**TC6405****TECHNOLOGY OF FABRIC MANUFACTURE****L T P C****3 1 0 4****OBJECTIVES:**

The main objective of this course is to enable the students to understand

- Preparatory processes involved in the production of fabric
- Basics of weaving and knitting processes
- Basics of nonwoven production methods

**UNIT I PREPARATION OF YARNS FOR WEAVING AND KNITTING****9**

Objects of winding – Different types of winders – Parallel winding, cross winding and precision winding. Conventional and automatic winding machines. Yarn clearing and splicing – Types of tensioners, guides. Weft winding - Pirn winding: Types and working principle of pirn winding machines – bunching, stop motions – Features of automatic pirn winding machine. Warping - Beam warping machines – creels – features of modern warping machines - sectional warping machine. Types and selection of ingredients for sizing, Size recipe for various types of fabrics, Sizing machines – multi-cylinder & hot air sizing – Methods of drying– Modern development in Sizing, Single end sizing. Drawing-in and Denting.

**UNIT II PLAIN POWER LOOM****9**

Types of looms - Primary, secondary and auxiliary mechanisms of loom, - Classification of weaving machines. Shedding - Tappet shedding, Shuttle Picking mechanism – Beat-up mechanism. Stop motions – Friction Let – off motion - Negative let off and positive let off motions. Take- up motion - Five wheel take up motion, Seven wheel take up motion, Positive continuous take up motion. Warp

protector Mechanisms - Loose Reed and Fast Reed Mechanisms, Warp Stop Motions, Weft stop motions, temples, lease rods and brake. Weaving faults. Brief study about drop box loom and Terry loom.

**UNIT III DOBBY AND JACQUARD SHEDDING 9**

Principles of working of single lift and double lift dobbies. Methods of pegging. Negative and positive dobbies. Cross boarder, paper, cam and rotary dobbies. Single lift and double lift Jacquards. Open shed jacquards. Electronic jacquards.

**UNIT IV SHUTTLELESS WEAVING 9**

Yarn quality requirements for Shuttleless looms, Principles of weft insertion in shuttleless loom - Mechanisms of weft insertion by Projectile, Rapier, Airjet and Waterjet looms - Techno economics of shuttleless weaving. Defects in woven fabrics – causes and remedies.

**UNIT V BONDED FABRICS & KNITTING 9**

Types of bonded fabrics. Web preparation for bonding – Different type of Bonding – Mechanical, Thermal and Chemical. End uses of bonded fabrics. Knitting – weft and warp knitting. Knitted fabric properties.

**TOTAL : 60 PERIODS**

**OUTCOMES:**

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

- Explain the preparatory processes involved in the production of fabrics
- Explain the principles of different fabric production methods
- Identify various fabric defects and their causes and remedies

**TEXT BOOKS:**

1. Sriramulu P.K., Ajgaonkar D.B. & Talukdar M.K., Weaving Machines: Mechanisms, Management, Mahajan Publishers, Ahmedabad, 1998.
2. Lord P.R. and Mohammed M.H., Weaving – Conversion of Yarn to Fabric, Merrow Publication, 1992.

**REFERENCES:**

1. Modi J.R.D., Sizing Ingredient, Mahajan Publications, Ahmedabad
2. Ormerod A., Modern Preparation and Weaving, Merrow Publication Co. U.K. 1988.
3. Talukdar M.K., “An Introduction to Winding and Warping” Testing Trade Press, Mumbai.
4. Talavasek O. & Svaty V., Shuttleless Weaving Machines, Elsevier Scientific Pub. Co., New York 1981.
5. Adanur S., Handbook of Weaving, Technomic Publishing Co., Inc., 2001.

**TC6411**

**WET PROCESSING PREPARATION LABORATORY**

**L T P C  
0 0 3 2**

**OBJECTIVE:**

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

**LIST OF EXPERIMENTS**

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 & Bleaching 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

- Determine the contents of chemicals
- Efficiency of different processes of wet processing preparatory
- Carryout scouring and bleaching of different textile materials

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

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

**TC6412**

**TEXTILE PHYSICAL TESTING LABORATORY**

**L T P C  
0 0 3 2**

**OBJECTIVE:**

To practice the students in testing of fibres, yarns and fabrics for important properties.

**LIST OF EXPERIMENTS**

1. Measurement of Fibre Length
2. Measurement of Fibre Fineness
3. Determination of yarn count from fabric sample by basely balance
4. Measurement of a) Linear density of sliver, roving and yarn. b) Single yarn and ply yarn twist.
5. Measurement of Single yarn strength and Lea strength.
6. Measureement of Yarn Impact Strength.
7. Measurement of Fabric thickness, Stiffness and Crease recovery.
8. Measurement of a) Fabric Tensile Strength. b)Fabric Bursting strength
9. Determination of Yarn Crimp.
10. Determination of GSM
11. Determination of twist

**TOTAL: 45 PERIODS**

**OUTCOMES:**

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

- Measure length and fineness of fibres
- Measure linear density, twist and strength of yarn and

- Measure thickness, stiffness, crease recovery and strength of fabrics using instruments.

### **LIST OF EQUIPMENT FOR BATCH OF 30 STUDENTS**

1. GSM Cutter
  2. Crimp Tester
  3. Thickness gauge
  4. Electronic Twist tester
  5. Lea strength Tester
  6. Stiffness Tester
  7. Crease recovery tester
  8. Baer sorter
  9. Bursting strength tester
  10. Tear strength tester
  11. Fibre Fineness Tester
  12. Projection microscope
  13. Wrap Block
  14. Wrap Reel
  15. Tensile Strength Tester
  16. Single Yarn Strength Tester
  17. Conditioning oven
  18. Stelometer
  19. Trash separator
  20. Yarn appearance board winder
  21. Drape meter
  22. Abrasion resistance tester
  23. Crock meter
  24. Pilling Tester
- (Each one number)

**TC6413**

**YARN AND FABRIC MANUFACTURING LABORATORY**

**L T P C  
0 0 3 2**

### **OBJECTIVES:**

To expose the students to the

- Machinery used for production of yarn from fibres and
- Weaving preparatory machines and looms

### **LIST OF EXPERIMENTS**

#### **YARN MANUFACTURE**

1. Sketching the various parts of blow room indicating the passage of material giving the settings and speeds.
2. Sketching the various parts of card indicating the passage of material giving the settings and speeds
3. Drawing the passage of material through a draw frame and give the settings and speeds.
4. Give the passage of material through the comber with settings and speeds.
5. Draw the passage of material through speed frame and give the settings and speeds. Also Sketch the building mechanism of simplex.
6. Study the construction details of ring frame and give the settings and speeds. Also sketch the builder motion mechanism of ring frame.

## FABRIC MANUFACTURE

7. Drawing the passage of material through a cone winding machine and give the settings and speeds.
8. Assembling and setting to time the dismantled parts of the shedding mechanism.
9. Assembling and setting to time the dismantled parts of cone over pick mechanism or side lever under pick mechanism.
10. Assembling and setting to time the dismantled parts of beat-up mechanism.
11. Assembling and setting to time the dismantled parts of 7 wheel take-up motion.
12. Assembling and setting to time the dismantled parts of Negative let-off mechanism.

**TOTAL : 45 PERIODS**

### OUTCOMES:

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

- Explain the construction of machines used for the production of yarns and
- Explain the different mechanisms of looms

### LIST OF EQUIPMENT FOR BATCH OF 30 STUDENTS

1. Miniature Blow room Line
2. Carding
3. Draw Frame
4. Comber
5. Speed Frame
6. Ring Frame
7. Cone / Cheese winding Machine
8. Automatic loom with all mechanisms related to the practical works mentioned (Each one machine)

**TC6501**

**CHEMISTRY OF TEXTILE AUXILIARIES**

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

### OBJECTIVES:

- To provide the knowledge on classification and types of textile auxiliaries
- To provide the knowledge on importance and basic functions of textile auxiliaries
- To enable the students to know about the chemistry of textile auxiliaries

#### UNIT I

**9**

Auxiliaries: Importance and functions; Surfactants: Mode of action and classification of surfactants – cationic, anionic, nonionic and amphoteric surfactants.

#### UNIT II

**9**

Auxiliaries associated with De-sizing, scouring, Bleaching of cellulosic fibres, Protein fibres and synthetic fibres.

#### UNIT III

**9**

Auxiliaries associated with Dyeing with Direct Dyes, Reactive, Vat, Azoic colors, Sulphur dyes, Acid dyes, Metal complex dyes, Basic and Disperse dyes.

#### UNIT IV

**9**

Auxiliaries associated with printing: Direct Style of Printing, Discharge style of Printing, Resist style of printing.

**UNIT V****9**

Auxiliaries used in Resin Finishing, Stiff finishing, soft finishing, Water repellent, Water Proof, Flame retardant, Soil release.

**TOTAL : 45 PERIODS****OUTCOMES:**

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

- Understand about the textile auxiliaries which would enable the student to work in the textile auxiliaries manufacturing companies.
- Perform research and development in the field of textile auxiliaries.

**TEXTBOOKS:**

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

**REFERENCE:**

1. John Shore, Colourants & Auxiliaries: Wiley and Sons Ltd, New York, Volume I & II,1999

**TC6502****WET PROCESSING MACHINERY****L T P C  
3 0 0 3****OBJECTIVES:**

To enable to students to learn about the

- Working principles of wet processing machineries
- Operations of machines and its maintenance schedules

and expose the students to the latest machineries used for wet processing.

**UNIT I FIBRE AND YARN PROCESSING****9**

Classification of Textile processing machinery: Batch – Semi-continuous – Continuous. Yarn – Rope, open width fabric processing machines. Loose stock dyeing machines: types. Yarn Processing: Singeing – Mercerizing. Yarn dyeing machines: Types - HTHP – Cabinet – Package. Dryers: Revolving cabinet - Pressurized package - continuous hank dryer – Radio frequency dryer.

**UNIT II FABRIC PROCESSING****9**

Singeing – Cropping – Shearing. Mercerizing - foam merceriser. J Box – Vapourloc - Semi continuous – Displacement washing - Centrifuging system – Winch: Modifications - Jigger: Jumbo - Universal. Pad dyeing machine: Pad – roll - Pad–batch – Vertical pad – Horizontal pad – Calculation of expression. Continuous dyeing range (CDR) – Thermosol - Beam dyeing - HTHP beam dyeing - Jet dyeing machines: Principle – Fully and partially flooded - Liquor flow – Airflow machine. Soft flow jet dyeing machine.

**UNIT III PRINTING MACHINES AND DRYERS****9**

Roller printing machinery. Screen printing: Automatic flat bet screen - Rotary screen. Thermo transfer printing machinery. Garment printing machines. Steamers – Agers – Curing process. Extraction of water: Hydroextractors - Cylinder drying - Stenters – High frequency stenter. Float dryers - Hot flue dryers - Perforated drum dryers – Heating systems – Steam – Thermic fluids – Heat requirement.

**UNIT IV FINISHING MACHINES AND WASHERS 9**

Calendars - Sanforizing machines – Raising – Emerising – Crepping. Milling – Crabbing - Decatising. Washing Machines: Mass transfer action – Counter-current – Intensification - Rope washing – Slack, tight water mangles - Suction drum washer - Horizontal washer.

**UNIT V HOSIERY AND GARMENT PROCESSING 9**

Scutcher – Detwisting – Rope piler – Tubular singeing, merceriser – Combined mercerizing and bleaching – Balloon pad – Tubular compacting - Relax dryer. Garment dyeing machinery: Horizontal - Overhead paddle dyeing machine - Rotary dyeing – Jet – Extractors – High temperature machines. Tumbler driers – Garment finishing machines.

**TOTAL : 45 PERIODS**

**OUTCOMES:**

Upon completion of the course, the students would

- Know various machinery used in yarn and fabric dyeing
- Know various machinery used for printing and finishing of fabrics which would help them in working in dyeing and printing industry

**TEXTBOOKS:**

1. Bhagwat R.S., “Hand book of Textile Processing Machinery” Colour publications, Mumbai 1999
2. Karmakar S R, Chemical Technology in the Pretreatment process of Textiles, Elsevier Publications, 1999.

**REFERENCES:**

1. Cegarra C., Puerte P., Valladperas J., “The Dying of textile Material” Textila Publishers, Italy, 1992.
2. Madaras G.W., Parish G.J., and Shore J., Batchurise dying of woven Cellulosic Fabrics(A Practical Guide) Society of dyers and Colurists Bradford, 1993.
3. Charles Tomassino, Chemistry and technology of fabric preparation and finishing, North Carolina State University, 1992.

**TC6503**

**DYEING OF TEXTILE MATERIALS– I**

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

**OBJECTIVES:**

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

**UNIT I**

**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** **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** **9**  
Dyeing of Indigo (synthetic indigo. Dyeing of cellulose materials with phthalogen blue, mineral khaki, aniline black, pigments. Azoic colours – Chemistry and general properties of Azoic colours – Concept of naphthols and bases.

**UNIT IV** **9**  
Sulphur dyes – Chemistry and general properties of sulphur dyes. Principle steps involved in sulphur dyeing. Shop floor practices of dyeing of cellulosic materials with sulphur dyes. Stripping of sulphur dyes. Practical problems and their remedies.

**UNIT V** **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

**TOTAL : 45 PERIODS**

**OUTCOMES:**

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

- Dye the cellulosic textiles with different dyes
- Perform research and development in the field of dyeing of cellulosic textiles

**TEXTBOOKS:**

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

**TC6504**

**TECHNOLOGY OF PRINTING – I**

**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** **9**  
Definition of printing – Difference between printing and dyeing – 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** **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** **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** **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, conversion style of discharge printing

**UNIT V** **9**

Printing paste formulations, printing of silk with various classes for dyes. Direct, discharge and resist styles of printing. Print paste formulations. Direct, discharge and resist styles of printing on woolen materials.

**TOTAL : 45 PERIODS**

**OUTCOMES:**

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

- Understand the concepts of printing of fabrics
- Contribute more trends and new developments to the printing industry

**TEXTBOOKS:**

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

**REFERENCES:**

1. Kale D.G. "Principles of Cotton Printing edition – 2", Mahajan Books, Ahemedabad. 1979
2. Chakraborty, J.N, Fundamentals and Practices in colouration of Textiles, Woodhead Publishing India, 2009, ISBN-13:978-81-908001-4-3

**TC6505**

**COMPUTER COLOUR MATCHING**

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

**OBJECTIVES:**

- To enable the students to understand various colour theories
- To simulate shade matching and predict recipes using CCM
- To discuss more about responsibilities of each department in garment industry and their working procedure

**UNIT I** **9**

Colour perception, theories of colour vision, colour measurement. Reflectance Spectrophotometer--Basic components of Reflectance Spectrophotometer-Types of Spectrophotometer-Spectrophotometer performance Parameter-Spectrophotometer selection parameter-precautions for Spectrophotometer-Calibration of spectrophotometer-main features of morden spectrophotometer-New commercial spectrophotometer--Tristimulus colorimeters-Gloss meters-multi-angle spectrophotometer-Features of commercial multi-angle spectrophotometer-commercial

multi-angle spectrophotometer-multi-angle viewing booth for visual assessment-new development multi-angle spectrophotometers-non-contact spectrophotometers -reflectance curves.

## **UNIT II**

**9**

The CIE color specifications – Computation of tristimulus values-XYZ from reflectance values – The CIE standard illuminants – The CIE standard observer – computation of tristimulus values – chromaticity coordinates & chromaticity diagram – Features of CIE system – Limitations of the CIE systems – The CIELAB color specification – CIELAB color space – CIELCH color space – Kubelka – Munk relation & concentration of colorant – Features of Kubelka-Munk function – Modification to K-M theory, Four-Flux theory & Multi-Flux theory – Color difference equations & color difference calculations – color difference & grey scale rating – Metamerism & metamerism index – Types of metamerism – Light booth for visual assessment of metamerism – color constancy & color inconstancy index – Pass/Fail – Shade short program – Relative dye strength analysis program – Whiteness / Yellowness index – yellowness index – Contrast ratio & opacity calculations – Reflectance of translucent samples – color matching programs – K-S data generation – color matching – Ratch correction – statistical analysis in QA & color matching applications

## **UNIT III**

**9**

Sample preparation, presentation & measurement – Selection of spectrophotometer - Sample preparation & presentation – Textiles & dye application .The basic laboratory equipments for successful handling of computer color matching system – The CIE color specifications in textiles applications - The CIE color specifications of dyes – Change in Hue with increase in concentration – Chromaticity coordinates & chromaticity diagram – Dye gamut mapping – Setting tolerances – Studying the compatibility of dyes – Color difference assessment – Color difference of self colors – colour difference using different color difference equations.

## **UNIT IV**

**9**

colour difference & metamerism – Metamerism index & number of dyes per combination – Color inconstancy index(CII) – The Color inconstancy index of dyes – The CII & the concentration of a dye – The CII of mixtures of dyes – Fastness rating – Pass/Fail – Specifying tolerances –Shade sort – Shade sort using 555 method – Advanced shade sort methods – Color strength analysis – Relative strength methods – linear region of dyes – color strength & residual color difference – color strength of navy blue & black – color strength of dyes with the same color index number .

## **UNIT V**

**9**

color strength of fluorescent dyes & residual color difference – whiteness index & yellowness index - whiteness index of various natural & man-made fibres - whiteness index using different WI equations –whiteness of OBA treated samples – whiteness & tint of OBA – Whiteness of OBA with tinting agent – Whiteness & aperture size of spectrophotometer – Whiteness on different spectrophotometers with PXF light source – Whiteness measurement with & without UV filter – Whiteness measurement of UV-filters with different cut-off wavelength – Whiteness index & the whiteness of basic substrate – effect of washing on whiteness – whiteness of white substrates for medicalware & hospitalware – calculating relative strength of OBA – Soil removal evaluation of detergents - yellowness index of white & near – white textile substrates –Studies in dye behaviour – Dye build-up properties - Linear and non linear behavior of dye – fastness properties –compatibility of dye standard depth and its calculation.

**TOTAL : 45 PERIODS**

## **OUTCOMES:**

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

- Understand colour theories, different measures of colour and specifications
- Predict recipes using CCM which would enable them to provide job opportunity in the field of testing and to carry out research.



**TEXTBOOKS:**

1. Johnson,A, 'The Theory of Colouration of Textiles', SDC 2nd Edition,1998
2. Peters.A.T and Freeman,H.S 'Analytical Chemistry of Synthetic Colorants', Blackie, ISBN 0751402087.1991

**REFERENCES:**

1. Peters.A.T and Freeman,H.S 'Physico – Chemical Principles of Colour Chemistry', Blackie, ISBN :0751402109.1995
2. Colour Technology Tools, Techniques & Applications

**TC6506****DYEING OF SYNTHETIC TEXTILES****L T P C  
3 0 0 3****OBJECTIVES:**

To enable the students to

- Understand the colouration of synthetic textiles in the field of mass colouration and dyeing
- Solve the shop floor problems in the colouration process

and to expose the students to the latest developments in colouration of synthetic textiles

**UNIT I****9**

Mass Colouration of Polyester, Nylon, Acrylic and polypropylene, Advantages &amp; Disadvantages of Mass Colouration; Difference between Mass Colouration and Dyeing.

**UNIT II****9**

Polyester Dyeing: carrier, HTHP and thermosol methods of dyeing. CD polyester dyeing, micro denier PET dyeing. Practical problems and their solutions. Stripping of dyed PET

**UNIT III****9**

Dyeing of Polyester Blends: Various shop floor practices of dyeing of polyester/cellulosic-blended fabrics. Practical problems and their solutions. Various shop floor practices of dyeing of polyester/wool blended fabrics. Practical problems and their solutions. Dyeing of polyester with cationic dyes. Dyeing of Micropolyester fabric and its blends. Practical problems in dyeing.

**UNIT IV****9**

Dyeing of nylon. Dyeing with acid dyes-High temperature dyeing. Low temperature dyeing of Nylon 66 – Dyeing with disperse dyes. Barriness of dyeing – Dyeing of polyamide cellulosic blends – polyamide/wool blends, polyamide/ polyester blends- Stripping of Nylon dyed material. Practical problems and remedies in Nylon Dyeing. Dyeing of unmodified and modified polypropylene.

**UNIT V****9**

Dyeing of Acrylic Fibres: – Dyeing with cationic dyes – Effect of fibre saturation value, pH- Cationic, Anionic and polymeric retarder systems –stripping of cationic dyes, dyeing with disperse dyes, dyeing of acrylic blends, differentially dyeable acrylic fibres.

**TOTAL : 45 PERIODS****OUTCOMES:**

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

- Understand the colouration of synthetic fibres and solving problems related to the process
- Perform research and development work in the field of colouration of synthetic textiles

**TEXTBOOKS:**

1. Gulrajani, M.L., "Polyester Dyeing", IIT, New Delhi, 2001
2. Vaidya, A.A., and Datye, K.V., "Chemical processing of Synthetic Fibres and Blends", John Wiley and Sons, New Delhi, 1995

**REFERENCES:**

1. Shore, J. "Blend Dyeing", SDC, London, ISBN: 0901956740. 1998
2. Chakraborty, J.N, Fundamentals and Practices in colouration of Textiles, Woodhead Publishing India, 2009, ISBN-13:978-81-908001-4-3

**TC6511****DYEING OF SYNTHETIC TEXTILE LABORATORY****L T P C  
0 0 3 2****OBJECTIVE:**

To practice the students in dyeing of synthetic textile materials

**LIST OF EXPERIMENTS**

1. Effect of water hardness & pH in dyeing of polyester with disperse dyes.
2. Dyeing of Polyester using carriers.
3. Dyeing of Polyester by HTHP methods.
4. Carrier dyeing of Polyester/Cotton blended fabrics in laboratory jigger machine.
5. Exhaust dyeing of Polyester/Cotton blended fabrics with disperse/reactive system.
6. Exhaust dyeing of Polyester/Cotton blended fabrics with disperse/vat system.
7. Dyeing of Polyester /Cotton blended fabrics with pigments
8. Exhaust dyeing of Polyester/Viscose blended fabrics with disperse/reactive system.
9. Exhaust dyeing of Polyester/Viscose blended fabrics with disperse/vat system.
10. Dyeing of Polyester/Wool blended fabrics using disperse/acid system.
11. Dyeing of Polyester/Wool blended fabrics using disperse/basic system.
12. Dyeing of Polyester/Wool blended fabrics using disperse/metal complex dyes.
13. Dyeing of micro denier polyester fabric in winch machine.
14. Matching of shades with the help of computer colour matching system.
15. Dyeing of acrylic fibre with cationic dyes.
16. Dyeing of Nylon fabrics

**TOTAL : 45 PERIODS****OUTCOMES:**

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

- Dye polyester and blends of polyester with different dyes
- Dye Nylon, acrylic and other synthetic fibres
- Match the shades with the help of computer colour matching system

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

1. Beaker Dyeing machine
2. Water Bath with heating facility
3. Weighing Balance
4. Hardness Meter
5. pH Meter
6. Jigger
7. Padding mangle
8. Computer color matching system
9. Winch
10. HTHP Soft flow dyeing machine  
(Each one machine)

**OBJECTIVE:**

To practice the students in shade matching and testing of dyed fabrics for fastness properties.

**SHADE MATCHING****LIST OF EXPERIMENTS**

1. Self shade card preparation with direct dyes.
2. Self shade card preparation with Reactive Cold Brand dyes.
3. Self shade card preparation with Reactive Hot Brand dyes
4. Self shade card preparation with Reactive Vinyl Sulphone dyes
5. Preparation of compound shades using binary colours of Reactive Hot Brand Dyes
6. Preparation of compound shades using tertiary colours of Reactive Remazol Dyes
7. Matching of compound shades using binary colours of Reactive Hot Brand Dyes
8. Matching of compound shades using tertiary colours of Reactive Remazol Dyes
9. Prediction of recipe using computer colour matching system
10. Correction recipe prediction from computer colour matching
11. Measurement of delta-E

**QUALITY CONTROL****LIST OF EXPERIMENTS**

1. Absorbency test of scoured fabric.
2. Determination of different whiteness indices, yellowing indices of the bleached fabric.
3. Wash fastness of dyed/printed samples.
4. Light fastness of dyed/printed samples.
5. Rubbing fastness of dyed/printed samples.
6. Perspiration fastness of dyed/printed samples.
7. Chlorine fastness of dyed/printed samples.( Spot Test)

**TOTAL : 45 PERIODS****OUTCOMES:**

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

- Prepare shade cards and carryout shade matching
- Determine the efficiency of scouring and bleaching
- Measure fastness properties of dyed and printed fabrics

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

1. Computer color Matching with spectrophotometer – 1No.
2. Laundrometer – 1No.
3. Light Fastness Tester – 1No.
4. Crock meter – 1No.
5. Perspirometer – 1No.
6. Incubator – 1No.
7. Water Bath– 1No.
8. Weighing Balance – 1No.
9. Grey scales
10. Conical flasks

**OBJECTIVE:**

To practice the students in dyeing and printing of textile fabrics using different dyes

**LIST OF EXPERIMENTS**

1. Dyeing of cotton fabric with direct dyes.
2. Dyeing of cotton fabric with Cold Brand Reactive dyes.
3. Dyeing of cotton fabric with Hot Brand Reactive dyes.
4. Dyeing of cotton fabric with Remazol dyes.
5. Dyeing of cotton fabric with pigments colours using padding method.
6. Dyeing with Remazols by Pad – silicate method.
7. Stripping and Redyeing of Faulty dyeing (Reactive)
8. Effect of temperature on the dyeing of cotton with direct dyes.
9. Effect of salt on the dyeing of cotton with direct dyes.
10. Direct style of printing using hot brand reactive dyes.
11. Direct style of printing using Vinyl Sulphone dyes,
12. Direct style of printing using Pigment Dyes on cotton and P/C Blend.
13. Direct style of printing using Disperse Dyes.
14. Direct style of printing with Khadi on Hosiery.
15. Silver print on hosiery fabrics.
16. Gold print on hosiery fabrics

**TOTAL : 45 PERIODS**

**OUTCOMES:**

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

- Dye cotton fabrics using different dyes
- Demonstrate the effect of different parameters on dyeing
- Print woven and knitted fabrics using different dyes

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

1. Padding mangle
2. Winch
3. Jigger
4. Water Bath
5. Weighing Balance
6. Thermometer
7. Stop watch
8. pH Meter
9. Table Screen printing
10. Hot air oven
11. Curing Chamber
12. Lab Steamer
13. Hand Dryer
14. Mechanical Stirrer
15. Garment Printing Machine  
(Each one machine)

**OBJECTIVES:**

- To familiarize the students with the properties and application of various finishing agents on various textile materials through discussion, experimentation and observation.
- To enable the students to understand to solve the shop floor problems in the finishing
- To enable the students to understand different types of finishes required for different classes of textile materials of finishing and machines used for finishing through discussion and field visits.

**UNIT I****9**

Commercial importance of finishing and its classification. Resin finishing: Mechanism of creasing, Types of Resins .Anti crease, wash and wear, durable press resin finishing. Causes & remedies of strength losses of Resin finished fabric. Mechanism of Chlorine retention. Formaldehyde Release from Resin finished goods. Study about eco friendly method of anti crease finishing. Polycarboxylic acids for crease recovery finish.

**UNIT II****9**

Concept of Flame proof & flame retardancy. Concept of pyrolysis, Flame retardant finishes for cotton, Concept of waterproof and water repellent Finishes, Durable & Semi durable and Temporary finishes, Antimicrobial finish - Evaluation of anti microbial finish, Elastomeric finishes and Evaluation

**UNIT III****9**

Soil Release Finishing: Mechanism of soil retention & soil release. Various soil releases finishes for cotton, Polyester and its blends - Evaluation, Anti pilling Finishing: chemical and mechanical methods to produce anti pilling finish - Evaluation, UV Protection finishes- Evaluation. Detail study of antistatic finishes and Evaluation

**UNIT IV****9**

Detail study about mechanical finishing of textile materials like calendaring, compacting, raising, Sanforising, Peach finishing. Object of Heat setting. Various methods of heat setting and mechanism of heat setting. Foam Finishing:. Detailed study of various techniques of foam application. Drawbacks of foam finishing.

**UNIT V****9**

Brief study about stiffening and softening of textile materials, Mechanism in the weight reduction of PET by using alkali Micro encapsulation techniques in finishing process, Nano finish, Self cleaning finish. Brief study about Plasma Treatment. Study about Bio finishing

**TOTAL : 45 PERIODS****OUTCOMES:**

Upon completion of the course, the students would

- Know about the process of finishing of textile goods
- Understand the principle and method of application of various types of special finishes on textile fabrics

**TEXTBOOKS:**

1. V.A.Shennai, Technology of Finishing, Vol X, Sevak Publications, Mumbai
2. Perkins, W.S., "Textile colouration and finishing", Carolina Academic Press., U.K, ISBN: 0890898855.2004

**REFERENCES:**

1. Microencapsulation in finishing, Review of progress of Colouration, SDC, 2001

2. Chakraborty, J.N, Fundamentals and Practices in colouration of Textiles, Woodhead Publishing India, 2009, ISBN-13:978-81-908001-4-3
3. W. D. Schindler and P. J. Hauser Chemical finishing of textiles, Woodhead Publishing Cambridge England,2004

**TC6602**

**DYEING OF TEXTILE MATERIALS – II**

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

**OBJECTIVES:**

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

**UNIT I**

**9**

Pretreatment: Chemical composition of wool – Scouring of wool – Scouring in the form of loose wool, yarn and fabric – Milling, Grabbing and potting. Bleaching of wool – Carbonizing of wool – Chemical composition of silk – Degumming of silk with alkalis, Organic acid, organic amines and enzymes. Machines for degumming of silk yarn and fabrics. Bleaching of silk with reducing and oxidizing bleaching agents.

**UNIT II**

**9**

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

**UNIT III**

**9**

Reactive Dyes: Types of reactive dyes used for dyeing protein fibres – Type of chemical reactions involved in dyeing of wool and silk with reactive dyes – application of monochloro, dichloro triazine dyes on wool and silk – application of vinyl sulphone, difluoro, mono chloro primidyl dyes, bromo acrylamide dyes and bifunctional dyes on wool and silk. Striping and redyeing.

**UNIT IV**

**9**

Natural Dyes: Need for natural dyes – properties – classification – direct substantivity of – dyes with mordants – role of mordants – mordants suitable for protein fibres – dyeing of silk and wool with yellow dyes using turmeric, kamala, tesu, marigold, larkspur, dolu etc. Red dyes using safflower, manjit, patang and lac. Blue dyes using indigo. Black dyes using log wood. Advantages and drawbacks of natural dye. Striping and re-dyeing.

**UNIT V**

**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

- Dye protein textiles using different types of dyes
- Perform research and development work in the field of dyeing of protein textiles

**TEXTBOOKS:**

1. Bona, M., "An Introduction to Wool fabric finishing", The Textile Inst, Manchester, 1994, ISBN: 187081259X.
2. Gulrajani, M.L., and Gupta, S., "Wool dyeing and printing", IIT, New Delhi, 1990.
3. Gulrajani, M.L., "Chemical Processing of Silk", IIT, New Delhi, 1991.

**REFERENCES:**

1. Lewis, D.M., (Ed), "Wool dyeing", SDC, London, 1992, ISBN: 0901956538.
2. Brady, P.R., and Angliss, I.B., "Wool printing and wool dyeing", Textile progress, Vol.12, No3, The Textile Institute, Manchester, 1982, ISBN: 0900739614.
3. Chakraborty, J.N, Fundamentals and Practices in colouration of Textiles, Woodhead Publishing India, 2009, ISBN-13:978-81-908001-4-3

**TC6603****TECHNOLOGY OF PRINTING- II****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****9**

Printing paste formulation, selection criteria of dyes, Direct, Discharge and Resist styles of printing. Fixation and after treatments. Pigment printing of PET and blends. speckle printing,

**UNIT II****9**

Printing paste formulation, printing of polyamide with acid, disperse, metal complex dyes. Printing of acrylics with disperse and cationic dyes. Direct, discharge and resist styles of printing.

**UNIT III****9**

Various styles of printing on Polyester/Cellulose, Polyester/Wool blended materials. Single dye application on blended fabrics, Process and quality control during printing. Brosso Prints and details for P/C blends.

**UNIT IV****9**

Preparation of knits and garments for printing, Khadi print, Plastic and Rubber print, Gold and Silver Prints on Hosiery by direct style method – Flock printing on Hosiery. Tie and Dye style, Batik printing, Crepon style of printing

**UNIT V****9**

Introduction of transfer printing, sublimation transfer, melt transfer, film release, wet transfer printing. Methods used for transfer printing, machines used for transfer printing. Garment Printing - Various techniques and machenieries of printing of garments.

**TOTAL : 45 PERIODS****OUTCOMES:**

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

- Understand printing of polyester, polyamides and blended fabrics using different types of colourants.
- Contribute more trends and new development to the printing industry

**TEXT BOOKS:**

1. Shenai V.A. "Technology of Textile Processing Vol. IV", Sevak Publications, Mumbai- 31. 1995
2. Storey, J. "Manual of Textile Printing", Thames & Hudson, 1992, ISBN: 0500680280
3. Chakraborty, J.N, Fundamentals and Practices in colouration of Textiles, Woodhead Publishing India, 2009, ISBN-13:978-81-908001-4-3

**REFERENCES:**

1. Datye K.V. & Vaidya, "Chemical Processing of Synthetic Fibres and Blends", John Wiley & Sons Publications, New York. 1995
2. Mills I.W.C. 'Textile Printing' SDC Perkin House, 82, Grattom Rd, Yorkshire, England., ISBN 0901956570. 1994
3. Cockett.S.R. "Dyeing & Printing", Sir Issac Pitman & Sons Canada Ltd., Pitman House Church St., Toronto. 1964
4. Prayag R.S. 'Technology of Textile Printing', Mrs. Prayag 127 Belgaum Rd, Dharwad 580008. 1986

**TC6604****INSTRUMENTAL METHODS OF CHEMICAL ANALYSIS****L T P C  
3 0 0 3****OBJECTIVES:**

- To enable the students to analyse the textiles and chemicals through various analytical instruments
- To enable the students to interpret the results from analytical instruments

**UNIT I****9**

UV – VIS spectroscopy - Theory, Franck - Condon principle, Electronic transitions, Deviations from Beer's law – Instrumentation (block diagram only) - Applications. Infra red spectroscopy – Theory, Fundamental vibrations, Hook's law – Instrumentation (block diagram only)- Finger print region – Vibrations involved in H<sub>2</sub>O and CO<sub>2</sub> - Applications.

**UNIT II****9**

NMR spectroscopy – Theory, Relaxation Process – Instrumentation (block diagram only) – Chemical shift – Internal standard – TMS – Shielding and De- Shielding Effects – Factors influencing Chemical shift - Applications. Mass spectroscopy: Theory, Instrumentation (block diagram only) – Ionization Techniques – Electron impact ionization, Chemical ionization and Desorption techniques. Nirogen rule, McLafferty rearrangement.

**UNIT III****9**

Potentiometric measurements – Ion selective electrodes – Glass electrode – Determination of pH – Buffers – Types of potentiometric titrations – Applications of Potentiometric measurements. Thermal Methods : Thermogravimetry – Factors affecting thermogravimetric curves – Instrumental and sample characteristics – Instrumentation (block diagram only) – Applications. Differential Thermal Analysis – Introduction – Factors affecting DTA curves – Environmental, Instrumental and Sample factors – Instrumentation (block diagram only) – Applications.

**UNIT IV****9**

Chromatographic Techniques – Introduction – classification – Theory, Instrumentation and Applications of Paper Chromatography, Thin Layer Chromatography, Column Chromatography, High Performance Liquid Chromatography and Gas – Liquid Chromatography.

**UNIT V****9**

Errors, Precision and Accuracy : Difinitions, Significant figures – Types of Errors – Methods of expressing accuracy and precision , Confidence limits.

**TOTAL : 45 PERIODS****OUTCOMES:**

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

- Analyze the textiles and chemicals using different analytical instruments
- Interpret the results from analytical instruments



**TEXT BOOKS:**

1. Rouessac,F., "Chemical analysis – modern international method and techniques", Wiely, New Delhi, 1999.
2. Day, R.A., and Unerwood, A.L., "Qualitative inorganic analysis, 5th edition", Prentice-Hall of India, New Delhi, 2004.

**REFERENCES:**

1. Bona,M., "Modern control Techniques in textile finishing and making up", Eurotex, Blachwells Bookshop, London, 2001
2. Banwell,G.C., "Fundamentals of molecular spectroscopy", TMH, 2003.

**TC6605****GARMENT MANUFACTURING AND PROCESSING****L T P C  
3 0 0 3****OBJECTIVES:**

- To enable the students to understand the basics of garment manufacturing, pattern making & sewing and garment wet processing
- To expose the students to various problems & remedies during garment manufacturing & processing

**UNIT I            PATTERN MAKING AND CUTTING****9**

Human body measurements – Methods - Pattern making – Grading - Method. Marker planning: requirements – Efficiency – Method – Marker making. Spreading: Requirements – Methods - Nature of fabric package – Machines. Cutting: requirements – Hand shears- Straight knife - Round knife – Band knife– Computer control – Die – Laser - Plasma torch – Water jet.

**UNIT II            SEWING****9**

Sewing machine fundamentals - Classification – Stitch forming mechanism – Industrial sewing machine working principle. Stitches –properties – Classes. Seams – Properties –Classes. Sewing threads – Types – Characteristics– Thread size – Ticket number.

**UNIT III           APPAREL PRODUCTION SYSTEMS****9**

Basic concepts – Plant layout – Product oriented layout - Process oriented layout – Progressing bundle System (PBS) – Unit Production System (UPS) – Modular Production System (MPS) – Flexible Manufacturing – work flow – Balancing - Buffer - Work study – Method analysis- Work measurement.

**UNIT IV            GARMENT DYEING****9**

Developments in garment processing and its future – Pre treatments for Garments- Dyeing of cotton and P/C Blended garments using reactive dyes & vat dyes. Dyeing of socks and hose – Dyeing of fasteners – Machines for garment dyeing – Paddle, rotary torodial –Solvent dyeing, sancowad process – Dyeing of wool and silk garments – Dyeing of polyester garments Problems in garment dyeing Remedies– Considerations and precautions to be taken for garment Dyeing – Pros and Cons of garment dyeing

**UNIT V            GARMENT FINISHING****9**

Wash down effects, stone wash, Enzyme wash, Bio – polishing, sand blasting- ION wash, mud wash, chalk wash, leather finish, feather touch, ozone fading & anti – ozonisation- Stain repellent finish. Pressing need – influence – equipments. Stone washing machines, tumble dryer, used look finishing machines, garment finishers- shirt finishers, pant finishers, cabinet finishers, tunnel finishers– Garment care and care labeling.

**OUTCOMES:**

Upon completion of the course, the students will

- Know about pattern making, cutting and sewing of apparels
- Know about dyeing and finishing of garments

**TEXT BOOKS:**

1. Gerry Cooklin, "Introduction to Clothing Manufacture" Blackwell Science Ltd., 1995.
2. Harrison.P.W Garment Dyeing, The Textile Institute Publication, Textile Progress, Vol .19 No.2,1988

**REFERENCES:**

1. Grace I. Kunz, Ruth E. Glock Apparel Manufacturing: Sewn Product Analysis, Prentice Hall; 4th edition , 2004.
2. Trotman.E.R."Dyeing and Chemical technology of textile fibres",B.I.Pub.,New Delhi.1994.
3. NCUTE – Programme series, Finishing of Garments and Knits, held at Ichalkaranchi, IIT,Delhi.
4. NCUTE – Programme series, Garment Manufacturing Technology, IIT, New Delhi.

**TC6611**

**TEXTILE FINISHING LABORATORY**

**L T P C  
0 0 3 2**

**OBJECTIVE:**

To practice the students in finishing of textile materials for different requirements and end uses

**LIST OF EXPERIMENTS**

1. Finishing the given fabric using 2 % starch.
2. Finishing the given fabric using 2 % softener
3. Buckram finish the given fabric sample using a suitable recipe.
4. Finish the sample using the given resin.
5. Giving water repellent Finish to the given fabric sample.
6. Finding the warp wise / weft wise shrinkage of the given fabric sample.
7. Crease recovery finishing of cotton.
8. Crease recovery finishing of P/C blends.
9. Comparison of different resins for crease recovery finishing of cotton.
10. Weight reduction of polyester.
11. Carbonisation of P/C blends.
12. Scroopy finish for silk.

**TOTAL : 45 PERIODS**

**OUTCOMES:**

Upon completing this course, the student would be able to

- Finish the fabric using starch, softners, resin, and water repellent, crease recovery finishes
- Finish the fabric for buckram finish and scroopy finish

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

1. Padding mangle
  2. Curing oven
  3. Water Bath
  4. Hand Dryer
  5. Weighing Balance
  6. Laundrometer
  7. Crease recovery tester
  8. Jigger
- (Each one machine)

**OBJECTIVE:**

To practice the students in manufacturing of garments and chemical processing of garments

**LIST OF EXPERIMENTS**

1. Design and construct A-Line frock for kids.
2. Design and construct Ladies Skirt.
3. Design and construct T-Shirt for men.
4. Dyeing of garments
5. Printing of garments using plastisol ink.
6. Metallic prints on garments
7. discharge prints on garments
8. transfer printing on garments
9. Khadi printing on garments
10. Bio-polishing on garments
11. Wrinkle free finish on garments
12. Stain proof finish on garments

**TOTAL : 45 PERIODS**

**OUTCOMES:**

On completion of this course, the student would be able to

- Design and construct garments for children, women and men
- Print the garment with different colourants
- Finish the garment for different applications

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

1. Garment dyeing machine – 1No.
2. Sewing machine – 10 Nos.
3. Garment washing machine - 1No.
4. Tumble dryer - 1No.
5. Ironing Table - 1No.
6. Table Screen printing Machine - 1No.
7. Curing chamber - 1No.

**OBJECTIVE:**

To practice the students in dyeing of wool, silk and special printing of fabrics

**LIST OF EXPERIMENTS**

1. Dyeing of wool & silk with Direct Dyes.
2. Dyeing of wool & silk with Basic Dyes.
3. Dyeing of wool & silk with Metal Complex Dyes.
4. Dyeing of wool & silk with Acid Dyes.
5. Dyeing of wool & silk with Natural Dyes.
6. Dyeing of wool & silk with Reactive Dyes.
7. Striping and re-dyeing of wool & silk.

8. Effect of pH on dyeing of wool/silk with acid dyes.
9. Effect of Electrolyte on dyeing of wool/silk with acid dyes.
10. Effect of Temperature on dyeing of wool/silk with acid dyes.
11. Effect of Time on dyeing of wool/silk with acid dyes.
12. Tie and Dye style of printing on cotton fabrics
13. Batik styles print on cotton fabrics.
14. White Discharge on Reactive ground.
15. Colour Discharge on Reactive ground.
16. Burn out style printing.

**TOTAL : 45 PERIODS**

**OUTCOMES:**

On completion of this course, the student would be able to

- Dye wool and silk using different dyes
- Demonstrate the effect of parameters on dyeing of wool and silk
- Carryout special printing on textile fabrics

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

1. Padding mangle
  2. Winch
  3. Jigger
  4. Water Bath
  5. Weighing Balance
  6. Thermometer
  7. Stop watch
  8. pH Meter
  9. Table Screen printing
  10. Hot air oven
  11. Curing Chamber
  12. Lab Steamer
  13. Hand Dryer
  14. Mechanical Stirrer
- (Each one machine/equipment)

<b>TC6701</b>	<b>WATER AND EFFLUENT TREATMENT AND POLLUTION CONTROL</b>	<b>L T P C</b>
		<b>3 0 0 3</b>

**OBJECTIVES:**

- To impart awareness about the pollution created by different stages of wet processing
- To familiarize the students about the importance of water and its analysis
- To enable the students to understand about the waste water treatment plants and various treatments carried out

**UNIT I**

**9**

Constituents of water and their effect on Textile wet processing –Water pollution – programmes which includes WHO, ISO standards for raw water criteria – Effluent discharge standards for inland surface water public sewers, on land for irrigation, marine coastal areas and drinking water parameters – Quality requirements of water for cotton and synthetic Textile processing . Water softening .Water analysis- Colour, pH value, dissolved solids, suspended solids, total hardness (Calcium + Magnesium)- EDTA method, total iron-thiocyanate method, Alkalinity, acidity , chlorides dissolved oxygen , BOD and COD.

**UNIT II** **9**  
Characteristics and treatment of cotton, synthetics and wool processing effluents. Reduction of pollution load. Introduction - Textile Effluent treatment methods-. Primary treatment methods - screening, sedimentation, equalisation, neutralisation, coagulation and flocculation.

**UNIT III** **9**  
Secondary treatment methods – Trickling filtration, Activated sludge process, aerated lagoons, secondary sedimentation, oxidation ponds, Anaerobic Digestion, sludge disposal, removal of interfering substances in secondary biological treatment.

**UNIT IV** **9**  
Tertiary treatment – Evaporation (solar and steam). Membrane technologies (MF, UF, NF & RO) ,Reverse osmosis, ion exchange and activated carbon treatment. Model schematic diagram for – Wastewater treatment plant for textile mills – Primary and Secondary units & Tertiary treatments, Quality parameters at entry and exit of RO. Chlorine trioxide treatment, ozone treatments, enzymatic decolourisation.

**UNIT V** **9**  
Air Pollution – Gaseous and Aerosols – Effects of air pollution – Effect of Sulphur oxide on human health – Properties of air pollutants – control of air pollutants – Air pollution control equipment – Ambient air quality standards – Emission limits at chimney level –Noise pollution – Types of noise (Steady state noise – Impulse noise) –ill effects of noise –Noise measurement – Control of noise pollution – Shape noise levels in decibels.

**TOTAL : 45 PERIODS**

**OUTCOMES:**

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

- Understand the textile processing related causes for pollution
- Understand the effluent discharge standards and different processes involved in waste water treatment
- Perform the research and development to produce zero discharge effluents

**TEXTBOOKS:**

1. Rao,C.S., “Environment Pollution control Engineering”, New age International Ltd. and Publishers, N.Delhi, 2004.
2. Reife, A., and Freeman, H.S., (Ed)., “Environmental chemistry of dyes and pigment”, Wiley., London, 2000, ISBN: 047158276.

**REFERENCES:**

1. Horrockks, A.R (Ed)., “Ecotextiles’98: Sustainable development”, The Text.Inst., Manchester 1999, ISBN: 1855732426.
2. Modak.P., “The textile industry and the environment”, UNEP:HMSO, Blackwells, Leeds, 2003, ISBN: 9280713671

**TT6701**

**TOTAL QUALITY MANAGEMENT FOR TEXTILE INDUSTRY**

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

**OBJECTIVES:**

- To enable the students to understand about total quality management, different TQM tools and techniques and Quality standards
- To train the students to apply TQM tools in textile industry

<b>UNIT I</b>	<b>INTRODUCTION</b>	<b>9</b>
Introduction - Need for quality - Evolution of quality - Definition of quality - Dimensions of product and service quality - Basic concepts of TQM – TQM Framework - Contributions of Quality Gurus – Barriers to TQM – Cost of Quality.		
<b>UNIT II</b>	<b>TQM PRINCIPLES</b>	<b>9</b>
Quality statements - Customer focus –Customer orientation, Customer satisfaction, Customer complaints, Customer retention - Continuous process improvement – PDCA cycle, 5S, Kaizen - Supplier partnership – Partnering, Supplier selection, Supplier Rating.		
<b>UNIT III</b>	<b>TQM TOOLS &amp; TECHNIQUES I</b>	<b>9</b>
The seven traditional tools of quality – New management tools – Six-sigma: Concepts, methodology, applications to spinning, weaving, chemical processing and garment industries – Bench marking – Reason to bench mark, Bench marking process – FMEA - Stages, Types		
<b>UNIT IV</b>	<b>TQM TOOLS &amp; TECHNIQUES II</b>	<b>9</b>
Quality circles – Quality Function Deployment (QFD) – Taguchi quality loss function – TPM – Concepts, improvement needs – Performance measures – BPR; application of TQM tools in textile industry.		
<b>UNIT V</b>	<b>QUALITY SYSTEMS</b>	<b>9</b>
Need for ISO 9000- ISO 9000-2000 Quality System – Elements, Documentation, Quality auditing- QS 9000 – ISO 14000 – Concepts, Requirements and Benefits - Quality Council – Leadership, Employee involvement – Motivation, Empowerment, Team and Teamwork, Recognition and Reward.		

**TOTAL : 45 PERIODS**

**OUTCOMES:**

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

- Understand the principle of TQM, different TQM tools and techniques
- Develop innovative tools to implement TQM in the textile industry

**TEXTBOOKS:**

1. Dale H.Besterfield, et al., “Total Quality Management”, Pearson Education Asia, Third Edition, Indian Reprint , 2006.
2. Suganthi,L and Anand Samuel, “Total Quality Management”, Prentice Hall (India) Pvt. Ltd., 2006

**REFERENCES:**

1. James R. Evans and William M. Lindsay, “The Management and Control of Quality”, (6<sup>th</sup> Edition), South-Western (Thomson Learning), 2005.
2. Oakland, J.S. “TQM – Text with Cases”, Butterworth – Heinemann Ltd., Oxford, Third Edition , 2003.
3. Janakiraman,B and Gopal, R.K, “Total Quality Management – Text and Cases”,Prentice Hall (India) Pvt. Ltd., 2006.

**TC6702 PROCESS AND QUALITY CONTROL IN TEXTILE WET PROCESSING L T P C  
3 0 0 3**

**OBJECTIVES:**

- To enable the students to learn about the process control at machinery involved in the chemical processing
- To familiarize the students about the importance of process control and quality control

- To enable the students to learn the various quality control tests involved in chemical processing

#### **UNIT I 9**

Definition of Process control and Quality control – Need for quality control in textile wet processing – Flow charts indicating Process control and Quality control tests to be carried out in Desizing, Scouring, Bleaching, Souring, Mercerizing, Dyeing, Printing and finishing – Identification and estimation of residual starch – Determination of weight loss during Desizing and Scouring – Estimation of Residual Wax content and Total wax content by Soxhlet extraction method – Estimation of Copper number – Determination of Cuprammonium fluidity – Determination of Acid groups by methylene blue absorption method – Absorbency tests by Drop test method and wicks method.

#### **UNIT II 9**

Determination of ash content – Determination of Whiteness and Whiteness retention - Determination of Barium Activity number – Shrinkage of fabric – Determination of Light fastness by xenon Arc lamp – Determination of fastness to Washing – Determination of fastness to Dry and Wet rubbing – Determination fastness to Alkaline and Acidic Perspiration – Determination fastness to Hot pressing – Determination fastness to Dry cleaning and sublimation.

#### **UNIT III 9**

Determination of efficiency of Water Proofing – Determination of efficiency of Flame Proofing – Determination of efficiency of Starching, by Bending length method – Determination of efficiency of Resin finishing by CRA. Estimation of residual formaldehyde present in resin finished fabric. Evaluation of efficiency of wetting agent by Sinking Time method – Evaluation of Dispersing agent – Evaluation of efficiency of detergents by Foam stability test – Identification of various fibres like Cotton, Viscose, Polyester, Wool, Acrylic and Nylon – Quantitative and Qualitative analysis of mixtures of blends like P/C, P/V, Acrylic/Cotton, Cotton/Viscose/Wool and Nylon/Acrylic/Cotton.

#### **UNIT IV 9**

Estimation of Purity of dyes by Dyeing Trails and by using Spectrophotometer. Concept of Computer Colour matching – Advantages of Computer colour matching system and its limitations – Working principle of computer colour matching – Estimation of purity of Sodium Hydrosulphite, Sodium Nitrite, Sodium silicate – Estimation of strength of Hydrogen peroxide, Estimation of available Chlorine in Hypochlorite solution. Identification of dyes on Cellulose fibre, Protein fibre and synthetic fibre.

#### **UNIT V 9**

Necessary of Eco-friendly processing – Concept of Eco-Friendly processing – The German Ban – List of banned Amines and Chemicals – Alternatives – Eco-labelling.-Tolerance limits of chemicals and auxiliaries in the export fabrics – Possible sources of contamination of red listed chemicals – ISO 14000 certification. Brief mention about the instruments used for measuring the various eco-parameters.

**TOTAL : 45 PERIODS**

#### **OUTCOMES:**

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

- Measure the quality particulars of textile material at different stages of chemical processing and know the standards
- carry out the various process and quality control measures during the chemical processing of textile materials

#### **TEXTBOOKS:**

1. Vaidya A.A. and Datye, K.K “Chemical processing of synthetic and blends”, John Wiley and Sons, New York, 1995.

2. Shenai V.A. – Technology of Textile Processing, Vol.8 Evaluation of Textile Chemicals, Edn.3, Sevak Publications, Mumbai 1995.

**REFERENCES:**

1. Indian Standard Institution (Delhi) – ISI Handbook of Textile Testing, Indian Standards Inst., New Delhi, 2004
2. AATCC Technical manual, 2008 Association of Textile chemists and Colorists. USA.
3. Orientation Programme on Wet Processing-Quality & Process Control, BITRA Publications. 1986

**TT6702**

**OPERATION RESEARCH FOR TEXTILE INDUSTRY**

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

**OBJECTIVES:**

To enable the students to learn about

- Various operations research (OR) methods that can be applied in the textile industry
- Designing of OR problem related to textile industry
- Method of solving OR problems

**UNIT I**

**9**

Scope of operation research, applications, limitations; linear programming problems – construction, solutions by graphical method, simplex method, Big M method; sensitivity analysis; application of LP technique for mixing optimization in spinning mill

**UNIT II**

**9**

Transportation problem – construction, initial basic feasible solution – North West Corner rule, lowest cost entry method, Vogel's Approximation Method; optimality test - MODI method, stepping stone method; replacement analysis

**UNIT III**

**9**

Assignment problem – construction, solution by Hungarian method, application in textile industry; sequencing problems; integer programming – construction, solving by cutting plane method

**UNIT IV**

**9**

Game theory- two person zero sum games, solving by matrix method, graphical method; Decisions theory - decisions under assumed certainty, decision under risk, decision under uncertainty, illustrations from textile industry; inventory control - EOQ models-deterministic models –probabilistic models

**UNIT V**

**9**

Project planning and control models: CPM, PERT – network representation, determining critical path, project duration; crashing of project duration; resource leveling

**TOTAL : 45 PERIODS**

**OUTCOMES:**

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

- Design operations research problems that can be applied to textile industry.
- Solve the OR problems

**TEXTBOOKS:**

1. Hamdy A Taha, "An Introduction to Operations Research, Prentice Hall, 8th Edition.
2. Panneerselvam R., "Operations Research", Prentice Hall of India, 2002
3. Sharma J. K., "Operations Research: Theory and Applications", Macmillan, 1997



**REFERENCES:**

1. Hillier and Lieberman, "Introduction to Operations Research", McGraw-Hill International Edition, Seventh Edition, 2001
2. W.J. Fabrycky, P.M. Ghare & P.E. Torgersen, "Applied Operation Research and Management Science", Prentice Hall, New Jersey, 1984
3. Tulsian P.C., "Quantitative Techniques Theory and Problems", Dorling Kindersley (India) Pvt. Ltd., 2006
4. Ronald L. Rardin, "Optimization in Operations Research", Pearson Education, 1998
5. Srivastava U.K., Shenoy G.V., Sharma S. C., "Quantitative Techniques for Managerial Decision", Second Edition, New Age International (P) Ltd., 2007
6. Gupta P. K., Hira D.S., "Problems in Operations Research", S. Chand & Company, 2002
7. Mustafi C.K., "Operations Research: Methods and Practice", 3rd Edition, New Age International (P) Ltd., 2007

**TC6711****PRODUCT DEVELOPMENT LABORATORY****L T P C  
0 0 3 2****OBJECTIVE:**

To practice the students in developing the textile products based on wet processing

**LIST OF EXPERIMENTS**

1. Development of Low temperature peroxide bleaching in soft flow
2. Development of combined desizing and scouring using bio technology
3. Development of dyeing of cotton fabric with Jigger
4. Development of dyeing of cotton fabric with Winch
5. Development of one bath dyeing of PET / CO blends
6. Development of producing of aroma / Ayurvedic finishing on textile materials

**TOTAL: 45 PERIODS****OUTCOME:**

Upon completing this practical course, the student would be able to develop textile products using dyeing, finishing with special finishes

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

1. Jigger
  2. Winch
  3. Padding mangle
  4. Soft flow dyeing machine
  5. Water Bath
  6. Beaker dyeing machine
- (Each one equipment)

TC6712

**PROBLEM ANALYSIS AND CASE STUDIES IN  
WET PROCESSING LABORATORY**

**L T P C  
0 0 3 2**

**OBJECTIVE:**

To expose the students to analysis of problems related to chemical processing of textile materials.

**LIST OF EXPERIMENTS**

1. Analyse the Problem & Case Studies in Desizing
2. Analyse the Problem & Case Studies in Scouring
3. Analyse the Problem & Case Studies in Bleaching
4. Analyse the Problem & Case Studies in Mercerizing
5. Analyse the Problem & Case Studies in Dyeing
6. Analyse the Problem & Case Studies in Printing
7. Analyse the Problem & Case Studies in Finishing ( Mecha FT6505 – Apparel Production Planning and Control nical and Chemical finishing)

**REFERENCE:**

Critical solution in Dyeing of Cotton Textile materials, R.Shamey & T.Hussg in Textile Progress Vol. 37 July 2005 Page 1-84.

**TOTAL : 45 PERIODS**

**OUTCOME:**

Upon completing this practical course, the student would be able to analyse the problems and find solutions for problems related to wet processing of textile materials.

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

1. Padding mangle
  2. Beaker Dyeing Machine
  3. Hot air oven
  4. Water Bath
  5. Table screen Printing
  6. Soft flow Dyeing Machine
  7. IR Dyeing Machine
  8. Steamer
  9. Weighing Balance
  10. Tensile strength tester
  11. Jigger
  12. Winch
  13. Laundro Meter
  14. Crock meter
- (Each one machine)

TC6801

**FINANCIAL MANAGEMENT IN TEXTILE INDUSTRY**

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

**OBJECTIVES:**

- To enable the students to understand basics of financial management that is required for the textile industry
- To enable the students to learn about sources of capital, cost of capital and capital budgeting

<b>UNIT I</b>	<b>INTRODUCTION TO FINANCIAL MANAGEMENT</b>	<b>9</b>
Definition – Nature & Scope-Finance Functions – Goals of Financial Management - Financial Manager's Role.		
<b>UNIT II</b>	<b>CAPITAL BUDGETING</b>	<b>9</b>
Nature and Principles- Cash Flows-Discounting cash flow techniques: Net present Value, Internal rate of return, Profitability Index- Comparison of Discounting Cash Flow Techniques- -Non-Discounting cash flow techniques: Pay back and Accounting - Rate of Return		
<b>UNIT III</b>	<b>COST OF CAPITAL</b>	<b>9</b>
Concept of cost of capital- Determining Component Cost of Capital- Specific Cost of Capital- Overall cost of capital – Capital Structure- Designing Capital Structure		
<b>UNIT IV</b>	<b>WORKING CAPITAL MANAGEMENT</b>	<b>9</b>
Principles and Concepts- Determinants - Operating Cycle - Cash Management-Short Term finance- Inventory Management- Receivable Management		
<b>UNIT V</b>	<b>LONG TERM SOURCES OF FINANCE</b>	<b>9</b>
Long term finance: Shares, debentures and -term loans, lease, hire purchase, venture capital financing, Private Equity- Trade Credit- Bank Finance- Commercial Paper		
		<b>TOTAL : 45 PERIODS</b>

**OUTCOMES:**

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

- Explain the basics of financial management applied to textile industry
- Understand the economical feasibility of capital investment, sources of capital and cost of capital applied

**TEXT BOOKS:**

1. M.Y. Khan and P.K.Jain Financial management, Text, Problems and cases Tata McGraw Hill, 5th edition, 2008.
2. I. M. Pandey Financial Management, Vikas Publishing House Pvt. Ltd., 8th edition, 2007.

**REFERENCES:**

1. James C. Van Horne - Financial Management & Policy Prentice Hall of India, .2009
2. I M Pandey - Financial Management Ninth Edition Vikas Publishing House2006
3. Prasanna Chandra - Fundamentals of Financial Management Tata McGraw- Hill 2009.
4. Khan Jain - Financial Management Tata McGraw- Hill 2009.
5. Periyaswamy, - Financial Management, Tata McGraw- Hill 2009

<b>TC6001</b>	<b>ECO - FRIENDLY DYES, CHEMICALS AND PROCESSING</b>	<b>L T P C</b>
		<b>3 0 0 3</b>

**OBJECTIVES:**

- To impart knowledge about the environmental and ecological aspects of various chemicals, dyes and auxiliaries used in processing.
- To make the students aware of the alternative chemicals and dyes that can replace the harmful chemicals.
- To update the students on the various rules, regulation that governs the textile processing industry.

**UNIT I INTRODUCTION 9**

Need – Concepts – Environmental Issues – Eco Standards. Environmental friendly fibres – Harmful substances in natural fibres – Eco-standards. Banned amines and toxic substances – Sources of contaminations – Approaches for Eco-processing: Reduce – Recycle – Reuse.

**UNIT II ECO-FRIENDLY PREPARATION, DYEING, PRINTING AND FINISHING 9**

Eco-friendly fabric preparation methods – Solvent assisted preparation – ozone bleaching – peracetic acid. Hazardous nature of synthetic dyes – types of hazards – alternative dyes. Eco-friendly chemicals and auxiliaries in dyeing and finishing: Reducing agents – oxidizing chemical – thickeners – sequestering agents – biosurfactants. Eco-friendly finishing chemicals: Cross-linking treatment – formaldehyde free chemicals – softeners – biopolishing – flame retardant finish – preservatives.

**UNIT III ECO-AUDIT 9**

Eco-audit – Procedure – Environmental Impact Assessment – Sampling methods – Audit methods. Reduction of pollution by prevention – Eco-testing. Environment Management System – Developments – ISO 14000 - Concepts – Clauses – Certifying bodies - Certification. Occupational safety and Hazards: OHSAS 18000 – Concepts – Clauses – Certification Methods. Introduction to Social Accountability 8000.

**UNIT IV ECO-NORMS AND ECO-LABELING 9**

Need – Assessment of toxicity - Norms for toxic chemicals: Carriers – Emulsions - Formaldehyde – Pesticides – Amines – Halogenated compounds - Heavy metals – Inorganic chemicals. Norms for baby clothing and adult clothing. Eco-labelling – Trade marks - Toxic substances in textile processing – Precautions – Assessment – Standards - Certifying Bodies.

**UNIT V TESTING OF ECO-PARAMETERS 9**

Instrumental Analysis – Chromatographic Methods – Spectroscopy – Inductively Coupled Plasma. Detectors: Flame & photo ionization – electron capture – Thermal conductivity – Flame photometer. Interpretation of test results.

**TOTAL : 45 PERIODS**

**OUTCOMES:**

- The study of this course would help the students to understand and comprehend the human and environmental hazards involved in day to day production activities in a textile wet processing mill.
- With the knowledge acquired from the other processing subjects along with his/her knowledge of the rules and regulations governing the processing industry he/she is better equipped to implement processes and new technologies which have lower environmental impact and so provide sustainable alternatives to the industry.
- This also helps and supports the students in making socially responsible and economically viable solutions

**TEXT BOOKS:**

1. Chavan R.B., Radhakrishnan J., Environmental Issues - Technology Options for Textile Industry, IIT Delhi Publication, 1998
2. Reife A and Freeman H.S., Environmental Chemistry of dyes and pigments, Wiley, 2001, ISBN: 0471589276

**REFERENCES:**

1. Asokan R., Eco-Friendly Textile Wet Processing, NCUTE Publications, New Delhi, 2001
2. Eco Textiles '98, Bolton Institute, 1998
3. Eco Textiles, Book of Papers, BTRA, 1996
4. Eco friendly Textiles: Challenges to the Textile Industry, Textiles Committee, Mumbai, 1996.

**OBJECTIVES**

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

**UNIT I****9**

Offset Printing-Rotogravure-Flexography-Letter press printing-Screen printing- Xerography printing-Ink jet printing-Digital printing-Lithography-Relief printing-Letter press printing-Electronic printing process-Electro photographic printing-Microcapsule printing-Thermal sublimation printing and wax transfer printing

**UNIT II****9**

Fabric preparation, Ink jet ink compositions; Mechanism of ink jet technology; Parameters influencing ink transfer; Colour depth in digital printing; Inks for printing – practical formulations; Precautions before and while printing; Selections of ink jet printers for fabric printing; Fixation / development of prints; After treatments.

**UNIT III****9**

Process control in printing. Process control parameters for printing machinery like rotary, flat bed, roller, loop steamers, agers, polymeriser, RIGHT FIRST TIME printings. Problems & remedies in printing.

**UNIT IV****9**

Garment Printing. Various techniques of printing of garments. garment printing machineries and their recent developments. Recent developments in printing technology.

**UNIT V****9**

Computer aided design systems for textile printing - Recent developments in textile printing machinery including automation. Developments in thickeners, water based binders,

**TOTAL : 45 PERIODS****OUTCOMES:**

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

- Understand the modern printing technologies available for printing textile fabrics.
- Contribute more trends and new development to the printing industry

**TEXT BOOKS:**

1. Ujiie, Digital Printing of Textiles, CRC,ISBN-10: 0849391008, Wood Head Publishing Ltd,UK,2006
2. Tyler, Textile Digital Printing Technologies, Textile Institute Publication UKVol.37 No.4, 2005
3. Chakraborty, J.N, Fundamentals and Practices in colouration of Textiles, Woodhead Publishing India, 2009, ISBN-13:978-81-908001-4-3

**REFERENCES:**

1. Miles.L.W.C., Textile Printing, Dyers company Publishing Trust, U.K., 1981
2. Shenai.V.A, "Technology of Printing", Sevak Publishers, Mumbai. 1990
3. Shore.J, Colorants & Auxiliaries, Vol. I & II, S.D.C, 1990

**OBJECTIVES**

- To enable the students to understand the importance of testing and analysis of various fibres and chemicals used in wet processing
- To expose the students to the analysis, estimation techniques for processing chemicals

**UNIT I BASIC CONCEPTS****9**

Need for an analytical laboratory – Testing for the quality of raw material for end product quality – Testing for toxic substances. Analysis and its effects in marketability, float and density gradient techniques – Dilute solution viscometer to find out viscosity of a polymer solution – Solubility of a fibre – Birefringence – Melting point – Fibre shrinkage – X-ray diffraction and its application in single fibre analysis.

**UNIT II ANALYSIS OF CHEMICALS IN PRETREATMENT****9**

Hardness of water – Determination procedure – Iron in water – pH of solution – Importance – Estimation of PH of a solution – Efficiency of desizing agents – Estimation of enzyme activity – Soapification – Analysis of oil for acid value and soap value, Iodine value – Efficiency of a wetting agent – Sinking time apparatus – Foam stability – Ionic nature of detergent – Efficiency of scouring process – Estimation of copper number – Ethylene Blue absorption – Fluidity, Cuprammonium fluidity – Use of Viscometer – Degree of mercerization – Estimation of Degree of mercerization – Barium activity number – Moisture regain dyeing test – Iodine absorption test – Determination of available chlorine in Sodium Hypochlorite solution --Testing of Bleached cotton fabrics for copper number and Methylene Blue absorption – Tests for aldehyde groups in Fehlings solution.

**UNIT III ANALYSIS OF CHEMICALS IN DYEING AND PRINTING****9**

Identification of dyes in powder form and from the dyed material. Estimation of the purity of dyes Estimation of the Efficiency of a cationic dye-fixing agent – Evaluation of leveling agent. Estimation of caustic and hydros contents in vat dye liquor – Evaluation of Carriers – Evaluation of dispersing agent for its dispersion stability – Evaluation of oxidising and reducing agents used in printing paste.

**UNIT IV ANALYSIS OF FINISHING CHEMICALS****9**

Types of textile softeners – Evaluation of cationic softeners by Methylene Blue method and Bromophenol Blue method – Evaluation of Bon-ionic softeners using ferric cyanide method and Phosphomolybdic acid method and Ammonium cobalt Thiocyanate method – Evaluation of anionic softeners – Evaluation of reactive softeners – Evaluation of Polyethylene emulsions by Estimating total solids and active content – Evaluation of water repellancy imparted by silicon emulsions by testing the treated samples for spray test, cone test, contact angle and capillary raise test – Evaluation different resins by test is the treated samples for total solids, total Formaldehyde and free Formaldehyde – Evaluation of fluorescent brightening agent.

**UNIT V EVALUATION OF COMMON CHEMICALS****9**

Estimation of the purity of the following chemicals, such as Hydrochloric acid, Sulfuric acid, Sodium Hydroxide, Sodium carbonate, Sodium Bicarbonate, Sodium Chloride and Sodium Sulphate – Estimation of Hydrogen peroxide content by iodimetry and permanaganometry – Estimation of the oxalic acid – Analysis of Potassium dichromate for total chromium content – Analysis of soap for moisture content unsaponifiable fat free alkyl and the total fatty acid – Estimation of Sodium hydro sulphate. Analysis of Sodium sulphide for its reducing power. Estimation of chemicals in mixtures viz Sodium carbonate/Sodium hydroxide and Sodium carbonate/Sodium bicarbonate

**TOTAL : 45 PERIODS****OUTCOMES:**

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

- Analyse textile fibres and chemicals used for wet processing textile materials
- Analyse chemicals used for dyeing, printing and finishing

**TEXT BOOK:**

1. Peters, A.T., and Freeman, H.S., (Ed), "Analytical chemistry of synthetic colorants", Blackie, London, 1994, ISBN:0751402087.

**REFERENCE:**

1. Reife, A., and Freeman, H.S.,(Ed)., "Environmental chemistry of dyes and pigment", Wiley., London, 1993, ISBN: 047158276

**TC6004****TECHNICAL TEXTILES****L T P C  
3 0 0 3****OBJECTIVE:**

To enable the students to learn about production, properties & application of various technical textile products viz., tyre cords, fabrics, belts, filter fabrics and medical textiles.

**UNIT I HIGH PERFORMANCE FIBRE 9**

Manufacture of glass filaments and staple fibre - manufacture of staple fibre yarn properties and applications of filament and staple fibre yarns. Asbestos Thread: Manufacturing process - properties and applications of asbestos yarn. Ultra High Modulus fibres - Carbon fibres - Aramid and related fibres.

**UNIT II TYRE CORDS AND FABRICS 9**

Requirements of tyre cord - suitability of various fibres-Polyester and Nylon tyre cords - manufacture of tyre cords - physical and mechanical property requirements of tyre cord fabrics- fabric design - Specifications - Rubberised textiles.

**UNIT III BELTS 9**

Conveyor belts - physical and mechanical properties-construction, manufacture of conveyor belts & power transmission belts. HOSE: Construction, applications and properties (physical and mechanical).

**UNIT IV FILTER FABRICS 9**

General consideration of filtration of solids from liquids, solid from gases, solids from solids, liquids from liquids, liquids from gases and gases from gases.

PROTECTIVE CLOTHING: Fire protection-thermal protection - electro-magnetic protection - water proof fabrics - protection against microorganisms, chemicals and pesticides - protection against aerosols.

**UNIT V MEDICAL TEXTILES 9**

Surgical Textiles - Suture threads, Cardio Vascular Textiles - Knitted cardiac biological valves. Dialysis Textiles- Hollow fibres as dialysis membrane. Hospital Textiles - Operation and post operation clothing—disposable draperies; sanitary applications.

GEO-TEXTILES: Geo Textile functions - raw materials - woven, non-woven and knitted geo textiles- Applications of geo-textiles for drainage, separation, soil reinforcement, filtration and erosion control. Textile materials in foot-wear, automotive, agriculture and maritime applications.

**TOTAL : 45 PERIODS****OUTCOMES:**

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

- Understand different high performance fibres and their properties
- Explain various method of production of technical textiles, their properties and applications

**TEXT BOOKS:**

1. Horrocks A. R., Anand S.C., "Handbook of Technical Textiles", Woodhead Publishing, Cambridge, 2000
2. Adanur S., "Handbook of Industrial Textiles", Technomic Publication, Lancaster, 2001

**REFERENCES:**

1. Kanna M.C., Hearle, O Hear., Design and manufacture of Textile Composites, Textile progress , Textile Institute, Manchester, April 2004.
2. Scott, Textile for production, Textile progress , Textile Institute, Manchester, Oct. 2005.
3. Shishoo, Textile in spot, Textile progress, Textile Institute, Manchester, Aug. 2005
4. Fung W., Collins & Aikman Textiles in Automotive Engineering , Woodhead Publishing Ltd., UK, 2000.
5. Kennady, Anand Miraftab, Rajandran, Medical Textile & Biomaterials for Health care, Woodhead publishing Ltd., UK, 2005

**TC6005****FIBRE REINFORCED COMPOSITES****L T P C  
3 0 0 3****OBJECTIVES:**

To enable the students to learn about

- Reinforcements, matrices used for the composites
- Manufacture of composites and
- Mechanics of failure of composites

**UNIT I INTRODUCTION****9**

Types of composites - fibre particulate and laminar composites - examples. Fibre composites: Constituents - functions of fibre and matrix — Properties of fibres — Critical fibre length - Aligned and random fibre composites — property prediction - rule of mixtures — simple problems.

**UNIT II COMPOSITE MATERIALS****9**

Types of high performance fibres - properties - types of matrix materials – Thermoset and Thermo plastics properties — short fibre composites — fibre matrix interface — coupling agents — coupling of interfaces and interfacial reaction in fibre composites - tensile strength of continuous and discontinuous composites -fracture mode in fibre composites.

**UNIT III PREPREGS****9**

Introduction to manufacturing techniques - property requirements — Textile preforms - weaving, knitting and braiding.

**UNIT IV COMPOSITE MANUFACTURING TECHNOLOGY****9**

Vacuum bagging - compression moulding — injection moulding - pultrusion – thermoforming — filament winding - resin transfer moulding.

**UNIT V PROPERTIES OF COMPOSITES****9**

Testing of composites— Fibre volume fraction -Laminar tensile - shear - compression - and flexural properties — interlaminar fracture/failure modes in composites – applications for composites.

**TOTAL : 45 PERIODS****OUTCOMES:**

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

- Select different types of textile reinforcements and matrices used for the manufacture of
- Composites and their behaviors and
- Understand the mechanics of failure of composites



**TEXT BOOKS:**

1. Hull.D, "An introduction to composite materials", Cambridge University Press - Cambridge, 1998
2. Gupta.L, "Advanced Composite Materials", Himalayam Books, New Delhi, 1998.
3. Textile Progress monogram on "Hybrid yarns and textile performing for thermoplastic composites" by R. Alagirusamy, R Fanguero, V. Ogale and N. Padaki Textile Progress 2006 Vol 38 No. 4 (Wood Head Publishing Limited)

**REFERENCES:**

1. Mathews F.L and Rawlings R.D "Composite Materials Engineering science" Chapman & Hall, London 1994.
2. Bogdanovich.A and Pastore.C, Mechanics of Textile and Laminated composites, Chapman & Hall, 1997
3. Hearle. J.W.S — "High performance fibres composites and engineering textile structures Journal of the textile institute (special issues) - The Textile Institute 1990.
4. Kostikov, V.L., Fibre Science and Technology (Soviet Advanced Composites Technology Series), Chapman & Hall, 1995.
5. Carlsson L.A. and Byron Pipes R. "Experimental characteristics of advanced composite materials" Prentice Hall, Inc 1987.
6. Pipes, R.B., Composite Material Series, Vol. 1 to 3, Elsevier, 2003.
7. Ken Ashbee, Fundamental principles of fibre reinforced composites, Technomic Publishing Co. Inc., Pennsylvania USA, 1989.
8. Leonard Hoilaway, Handbook of Polymer composites for Engineers, Woodhead Publishing Ltd., Cambridge, England, 2004.
9. Geier, M.H., Quality Handbook for Composite Materials, Chapman and Hall, London, U.K., 1994.
10. Gill R.M., Carbon fibres in composite materials, Butterworth Group, 2000.
11. De.S.K. and White J.R. Short fibre polymer composites, Wood head, Manchester,2001, ISBN:1855732203

**TC6006****CLOTHING SCIENCE AND PRODUCT ENGINEERING****L T P C  
3 0 0 3****OBJECTIVES:**

To enable the students to learn about the

- Measurement of properties of fabrics related to comfort
- Important characteristics of the fabric responsible for its comfort properties and
- Design logics of textile products and apparels.

**UNIT I****9**

**DIMENTIONAL STABILITY:** Hygral expansion - Relaxation shrinkage – Felting shrinkage - methods of measuring dimensional stability to dry cleaning and Dry heat.

**SERVICEABILITY:** Snagging - Pilling - Abrasion resistance - Tearing strength – Tensile strength - Bursting strength -Corrosive strength - Launderability - Crock resistance - Flammability - Scorching - Fusing - Static electricity - Seam strength and slippage

**UNIT II****9**

**COMFORT:** Thermal comfort & conductivity - Air permeability - Water vapour permeability - moisture transport - wetting - wicking - sensorial comfort – water absorption - water repellency – oil repellency – soil resistance.

**AESTHETICS:** Colour - colour fastness - shade variation – colour measurement

**UNIT III** **9**  
FABRIC HANDLE: Bending - Drape - Crease recovery - fabric thickness - Shear – Bias extension - formability - fabric friction - objective evaluation of fabric hand by KES and FAST

**UNIT IV** **9**  
INTRODUCTION TO DESIGN LOGIC OF TEXTILE PRODUCTS – Classification of textile products and components. YARN DESIGN : Material, technology, and specifications - yarn design elements - design based on structure and material properties  
FABRIC DESIGN : Material, technology, and specifications - Fabric design elements - design based on structure and material properties

**UNIT V** **9**  
DESIGN OF APPAREL FABRICS : Design of women's & Girl's wear - fabric types and materials for European, American and Indian styles - design of men's and boy's wear - fabric type and materials for European, American and Indian styles – Tailorability of fabrics – tailorability of woven and knitted garments – tailorability of leather garments – tailorability of fur garments.

**TOTAL : 45 PERIODS**

**OUTCOME:**

Upon completion of this course, the student shall be able to understand different phenomena such as wetting, wicking and, heat and moisture interaction and Engineer the textile products and design apparels.

**TEXT BOOKS:**

1. Ed Postle R., Kawabata.S and Niwa M., "Objective Evaluation of Fabrics", Textile Machinery Society, Japan, Osaka, 1983
2. Miller "Textiles: Properties and Behaviors in Clothing use", Textile Institute, 1998.
3. PradipV, Metha, " An Introduction to Quality Control for the Apparel Industry", ASQC Quality Press, Marcel Dekker Inc" New York, 1992

**REFERENCES:**

1. Wngate loB, and Mohler J.F. "Textile fabrics and their selection", Prentice -HallInc, New Jersey, 1984.
2. Mastudaira T, and Suresh M.N., "Design Logic of Textile Products", Textile Progress, Textile Institute, Manchester, 1997.
3. Slater.K., "Comfort Properties of Textiles", Textile Institute, Manchester, Vol 9, No..4, 1997.
4. Saville B.P, Physical Testing of Textiles, The Textile Institute, Wood head publishing limited, Cambridge, 1999.
5. Matisunita, Design Logics, Textile Progress, UK

**TC6007**

**NONWOVEN FABRICS AND SPECIALTY FABRICS**

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

**OBJECTIVES:**

To enable the students to learn about

- Production of fabrics by different non woven technologies
- Finishing and testing non wovens

and to expose the students to specialty fabrics, their construction and applications

**UNIT I INTRODUCTION 9**

Definition - Classification - Nonwoven manufacturing processes. Raw materials - Binders. Web forming - Lay process. Extrusion nonwovens-spun laying, spun bonding. Dry and wet lay process - Types - Raw materials - Fibre preparation - Process variables - Properties.

**UNIT II BONDING 9**

Needling: Principle - Needle characteristics - Process variables – Needled-fabric properties. Loop formation processes - Types - Process variables - fabric properties. Hydro entanglement process - Principle - Process variables - Fabric properties. Drying -Hot air bonding - Heat setting - Thermal calender bonding - Ultrasound bonding. Chemical bonding - Saturation bonding, Print bonding, Foam bonding and Spray bonding. Nonwoven composites

**UNIT III FINISHING AND TESTING 9**

Mechanical finishing: Shrinking - Compacting and creping, glazing – Calendering – Pressing – Perforating – Slitting – Breaking – Emerising – Raising – Shearing – Singeing – Sewing - Quilting and welding. Chemical finishing washing – Dyeing – Printing – Finishing - Softening - Special effects, coating, laminating and flocking Sampling and statistics - Testing conditions - Standards and specifications. Testing of raw materials and finished nonwoven fabrics. Quality control aspects in nonwoven production.

**UNIT IV APPLICATIONS AND PRODUCT DEVELOPMENT 9**

Nonwovens for hygiene, medicine – safety, cleaning, household products, home textiles - apparels and technical applications. Re-utllization of nonwovens Concepts and definitions - Product development for garments, decorative fabrics, home textiles and technical textiles. Costing of nonwoven products. Techno economics

**UNIT V SPECIALTY FABRICS 9**

Introduction - yarn and fibre types, fabrics. Preparation for narrow fabric production winding, warping, sizing, looming, Woven narrow fabrics and their constructions - structure of narrow fabrics woven on shuttleless looms. Conventional shuttle looms, unconventional shuttle looms and shuttle less looms for narrow fabrics, Elasticated fabrics, zip - fastener tapes, curtain - heading tapes, ladder tapes, trimmings, braids, labels, nets, laces, flocked fabrics – Coated and laminated textiles. 3D fabrics. Non-pile carpet weaves and their looms. Pile surfaced carpet weaves and their looms. Needle felt floor coverings.

**TOTAL : 45 PERIODS**

**OUTCOMES:**

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

- Understand different methods of production and testing of nonwovens and
- Understand different types of specialty fabrics

**TEXTBOOKS:**

1. Russel.S, "Handbook of Nonwovens", The Textile Institute Publication, 2007.
2. Wilhelm Albrecht etal., " Nonwoven fabrics", WILEY - VCH Verlag Gmbh & Company, Germany, 2003.

**REFERENCES:**

1. Irsak.C, " Nonwoven Textiles" Textile Institute", Manchester, 1999
2. Krcma.R., Manual of Non-wovens, Textile Trade Press, Manchester 1993.

**OBJECTIVES:**

- To enable the students to learn about the working principles of wet processing machineries.
- To enable the students to know about the operations of machines and its maintenance schedules
- To expose the students to latest wet processing machineries

**UNIT I****9**

Advances in continuous processing of cotton and wool materials - - Advances in heating systems hank and yarn dyeing machines(cheese and warp) - importance of winding in yarn dyeing — calculation of winding density - detailed maintenance schedule for cheese dyeing machines. Use of microprocessors in processing machines.

**UNIT II****9**

Advances in Beam dyeing - Advances in soft flow, over flow, jet dyeing machines — Developments in jiggers,—Detail maintenance schedule for beam dyeing, jet dyeing and jiggers.

**UNIT III****9**

Detail study and developments in vertical drying ranges - RF dryer, yarn dryer, tubular & open width knitted fabric dryer, Tumble dryer, developments in balloon padding, hydro extractor, rope opener, maintenance schedule for the above machines. Heating systems for hot air stenters, Clip & pin type of stenters; Jig stenters — over feeding system and its importance - Hot flue dryer — float dryer — maintenance schedule for the above machines.

**UNIT IV****9**

Developments in preparation of screens for roller, rotary, flat bed screen printing machines. Principle and working of fully automatic flat bed screen printing machine – with programmer line diagram and its advantages - developments in agers - Developments in garment printing machines - various practical problems & possible remedies, Transfer printing machines and dyeing.

**UNIT V****9**

Developments in finishing machineries — Calenders, sanforising machine, Back-filling machine, maintenance schedule for the above machineries. Shop floor problems & possible remedies in finishing department, Sand blasting machine, Peach finishing, Raising, Shearing machines.

**TOTAL : 45 PERIODS****OUTCOMES:**

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

- Understand about the advances in wet processing of textile materials
- Understand about advanced wet processing machinery used in the industry

**TEXTBOOKS:**

1. Gokhle S.V. and Dhingra A.K., "Maintenance in Chemical Processing Department of Textile Mills", , ATIRA, Ahmedabad,1984.
2. R.S.Bhagwat, "Development in Textile Processing Machines" Colour Publications pvt.Ltd, 2000.

**REFERENCES:**

1. Datye. K.V. and Vaidya. A.A., Chemical Processing of Synthetic fibres and blends, John Wiley & Sons, New York.1995
2. Chakravarth. R.R. Technology of Bleaching and Dyeing of Textile Fibres, Vol. 1 Part 2, , Mahajan Book Distributors, Ahmedabad. 1982
3. Usenko.V. Processing of Manmade Fibres, MIR Publishers, Moscow. 1995
4. Shirley Institute, Jet dyeing Machines, Shirley Institute Publications, (S 33).,U.K.1981

5. Shenai V.A. Technology of Textile Processing, Sevak Publication, 306, Sri Hanuman Industrial Estate, GD Ambedkar Road, Wadala, Bombay.1995
6. Cegarra,J., Puente,P., and Valldeperas,J., "The dyeing of Textile materials", The Text. Inst., Manchester, 1998, ISBN: 1870812581.
7. Viallier,P., "Heat transfers in Textile finishing industry", Eurotex, 1991, Blackwells Bookshop, Leeds, U.K.

**TC6009 ENERGY MANAGEMENT AND CONSERVATION IN TEXTILE INDUSTRY L T P C**  
**3 0 0 3**

**OBJECTIVES:**

To enable the students to learn about

- Consumption of energy at various sectors of textile industries
- Techniques of saving energy

**UNIT I SOURCES OF ENERGY 9**

Limitations of Natural resources. Unexploited energy sources and problems in their exploitation. Concept of energy management - need for energy conservation- global energy scenario with specific reference to India -Demand side Management (DSM).

**UNIT II ENERGY CONSUMPTION 9**

Spinning – Weaving – Knitting - Processing – Garmenting. Auxiliary machineries Component wise consumption - Specific energy consumption (UKG) - Cost of energy Vs sales value of textile product. Conservation of energy.

**UNIT III ENERGY AUDIT 9**

Concept - Types of audit - Instrumentation - methodology - analysis. Electrical and Thermal audit

**UNIT IV ENERGY CONSERVATION 9**

Techniques of energy saving: Energy efficient equipments for various processing machines and ancillaries – Preparatory – Spinning - Post Spinning - Weaving Wet Processing - Humidification/Air conditioning – Lighting – Compressors - Boilers – Generators. Different types of fuels. Economics of energy conservation techniques.

**UNIT V NON-CONVENTIONAL ENERGY SOURCES 9**

Solar energy: Different type of collectors – Photovoltaic cell - Wind energy - Bio energy - co-generation.Environmental impact on energy.Analog - Digital - Computerized instruments Measurement techniques. Maintenance of instruments.

**TOTAL : 45 PERIODS**

**OUTCOME:**

Upon completion of this course, the student would understand the consumption of energy at difference stage of processing, energy audit procedure, energy conservation and different types of non conventional energy sources available.

**TEXTBOOKS:**

1. Energy Conservation in Textile Industry, SITRA, 1985
2. Vallier,P," Energy uses in the Textile Finishing Industry", Eurotex, 1990
3. Palaniappan C et ai, "Renewable Energy Applications to Industries", Narose Publishing House, 1998.

**REFERENCES:**

1. Proceedings of International Seminar cum Exhibition ASIA Energy Vision 2020" - sustainable energy supply, November 15-17, 1996.
2. Proceedings of the Seminar, "Strategies for Sustainability of Energy Efficient and Environmental Friendly Technologies in Small and Medium Scale Sector", PSG College of Technology, November 24, 2000.
3. Pradeep Chaturvedi & Shaltni Joshi," Strategy for Energy Conservation in India", Concept Publishing Co. , 1995. Heat economy in Textile mills", ATIRA, Ahmedabad, 1996.
4. Energy conservation in Textile Industry", SITRA, Coimbatore,1997.
5. Vallier,P., "Energy uses in the textile finishing industry", Eurotex, 1999.
6. Sang Yang Kim, Grady, P.L. and Hersh, S.P., "Energy consumption and conservation in the fibre producing and textile industry", Textile Progress , Vol. 13, No.3, Textile Inst., Manchester, 1983

**GE6084****HUMAN RIGHTS****L T P C  
3 0 0 3****OBJECTIVES :**

- To sensitize the Engineering students to various aspects of Human Rights.

**UNIT I****9**

Human Rights – Meaning, origin and Development. Notion and classification of Rights – Natural, Moral and Legal Rights. Civil and Political Rights, Economic, Social and Cultural Rights; collective / Solidarity Rights.

**UNIT II****9**

Evolution of the concept of Human Rights Magna carta – Geneva convention of 1864. Universal Declaration of Human Rights, 1948. Theories of Human Rights.

**UNIT III****9**

Theories and perspectives of UN Laws – UN Agencies to monitor and compliance.

**UNIT IV****9**

Human Rights in India – Constitutional Provisions / Guarantees.

**UNIT V****9**

Human Rights of Disadvantaged People – Women, Children, Displaced persons and Disabled persons, including Aged and HIV Infected People. Implementation of Human Rights – National and State Human Rights Commission – Judiciary – Role of NGO's, Media, Educational Institutions, Social Movements.

**TOTAL : 45 PERIODS****OUTCOME :**

- Engineering students will acquire the basic knowledge of human rights.

**REFERENCES:**

1. Kapoor S.K., "Human Rights under International law and Indian Laws", Central Law Agency, Allahabad, 2014.
2. Chandra U., "Human Rights", Allahabad Law Agency, Allahabad, 2014.
3. Upendra Baxi, The Future of Human Rights, Oxford University Press, New Delhi.

**OBJECTIVES:**

- To enable the students to create an awareness on Engineering Ethics and Human Values, to instill Moral and Social Values and Loyalty and to appreciate the rights of others.

**UNIT I HUMAN VALUES****10**

Morals, values and Ethics – Integrity – Work ethic – Service learning – Civic virtue – Respect for others – Living peacefully – Caring – Sharing – Honesty – Courage – Valuing time – Cooperation – Commitment – Empathy – Self confidence – Character – Spirituality – Introduction to Yoga and meditation for professional excellence and stress management.

**UNIT II ENGINEERING ETHICS****9**

Senses of 'Engineering Ethics' – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Models of professional roles - Theories about right action – Self-interest – Customs and Religion – Uses of Ethical Theories

**UNIT III ENGINEERING AS SOCIAL EXPERIMENTATION****9**

Engineering as Experimentation – Engineers as responsible Experimenters – Codes of Ethics – A Balanced Outlook on Law.

**UNIT IV SAFETY, RESPONSIBILITIES AND RIGHTS****9**

Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk - Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination

**UNIT V GLOBAL ISSUES****8**

Multinational Corporations – Environmental Ethics – Computer Ethics – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Moral Leadership – Code of Conduct – Corporate Social Responsibility

**TOTAL: 45 PERIODS****OUTCOME :**

- Upon completion of the course, the student should be able to apply ethics in society, discuss the ethical issues related to engineering and realize the responsibilities and rights in the society

**TEXT BOOKS:**

- Mike W. Martin and Roland Schinzinger, "Ethics in Engineering", Tata McGraw Hill, New Delhi, 2003.
- Govindarajan M, Natarajan S, Senthil Kumar V. S, "Engineering Ethics", Prentice Hall of India, New Delhi, 2004.

**REFERENCES:**

- Charles B. Fleddermann, "Engineering Ethics", Pearson Prentice Hall, New Jersey, 2004.
- Charles E. Harris, Michael S. Pritchard and Michael J. Rabins, "Engineering Ethics – Concepts and Cases", Cengage Learning, 2009
- John R Boatright, "Ethics and the Conduct of Business", Pearson Education, New Delhi, 2003
- Edmund G Seebauer and Robert L Barry, "Fundamentals of Ethics for Scientists and Engineers", Oxford University Press, Oxford, 2001
- Laura P. Hartman and Joe Desjardins, "Business Ethics: Decision Making for Personal Integrity and Social Responsibility" Mc Graw Hill education, India Pvt. Ltd., New Delhi 2013.
- World Community Service Centre, ' Value Education', Vethathiri publications, Erode, 2011

**Web sources:**

- [www.onlineethics.org](http://www.onlineethics.org)

2. www.nspe.org
3. www.globalethics.org
4. www.ethics.org

**TT6503**

**KNITTING TECHNOLOGY**

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

**OBJECTIVES**

To make the students to understand

- Fundamentals of knitting
- Types of knitting processes in detail
- Functioning of components of knitting machine

**UNIT I INTRODUCTION**

**9**

Reasons for the growth of the knitting industry. Comparison of fabric properties - wovens, knits and bonded fabrics; classification of knitting processes – weft knit & warp knit; yarn quality requirements for knitting. Preparation of staple yarns for weft and warp knitting.

**UNIT II FUNDAMENTALS OF KNITTING**

**9**

General definitions and principles of knitting; Types of knitting needles – Bearded, Latch & Compound Needle. Elements of knitted loop structure.

**UNIT III WEFT KNITTING**

**9**

Basic weft knitted structures and their production - plain, rib, interlock and purl; Fundamentals of formation of knit, tuck and float stitches; factors affecting the formation of loop; effect of loop length and shape on fabric properties; Analysis of various types of weft knitted structure. Weft knitted fabric geometry.

**UNIT IV WEFT KNITTING MACHINES**

**9**

Construction, Characteristics and working of circular knitting machines used for the production of basic structures; production of derivatives of weft knitted structures; needle control in circular knitting machines; quality control in knitted fabric production; production calculation. Basic principles and elements of flat knitting machines; different types of flat knitting machines - manual, mechanical and computer controlled; production of various weft knitted structures using flat knitting machines.

**UNIT V WARP KNITTING**

**9**

Basic principles; elements of warp knitted loop – open loop, closed loop; warp knitting elements-chain link, chain links for simple patterns, guide bar movement mechanism,. Tricot and Rachel warp knitting machines. Principles of double needle bar patterning, Terry pile fabric production. Let off system; run in value based on the lapping diagram; take up system; theoretical concepts of warp knitted loop configuration.; Uses of warp knitted fabrics in technical applications.

**TOTAL : 45 PERIODS**

**OUTCOMES:**

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

- Principle of knitting by different types of knitting machines
- Structure and properties of fabric produced by different knitting machines

**TEXT BOOKS:**

1. Spencer D.J., “Knitting Technology”, III Ed., Textile Institute, Manchester, 2001, ISBN: 1 85573 333 1
2. Ajgaonkar D.B., “Knitting Technology”, Universal Publishing Corporation, Mumbai, 1998, ISBN: 81-85027-34-X



3. Gajjap B.J., "Handbook of warp Knitting Technology", Textile Institute, Manchester, 2004, ISBN: 1 85573 7701

#### REFERENCES:

1. Chandrasekhar Iyer, Bernd Mammel and Wolfgang Schach., "Circular Knitting", Meisenbach GmbH, Bamberg, 1995, ISBN: 3-87525-066-4
2. Samuel Raz., "Flat Knitting: The new generation", Meisenbach GmbH, Bamberg, 1997, ISBN: 3-87525-054-0
3. Samuel Raz., "Warp Knitting production", Melliand Textilberichte, GmbH, Rohrbacher, 1987, ISBN: 3-87529-022-4
4. Thomas D.G.B., "An Introduction to Warp Knitting", Merrow Publishing Company, UK., 1971, ISBN-13: 9780900541070
5. Sam Raz, "Warp Knitting Production", Melliand Textilberichte GmbH, Heidelberg, Germany, 1987, ISBN:3-87529-022-4
6. Die Maschenbindungen der Kettenwirkerai, "An Introduction to the Stitch Formations in Warp Knitting", Published Employee's Association, Karl Mayere.V., Germany, 1966
7. Paling D.F., "Warp Knitting Technology", Columbine Press, U.K, 1966
8. Charles Reichman, "Wool and Synthetic Knitwear Handbook", National Knitted Outerwear Association, U.S.A, 1967
9. Charles Reichman, "Knitted Stretch Technology", National Knitted Outerwear Association, U.S.A, 1965.

**TC6010**

**HOME TEXTILES**

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

#### OBJECTIVES:

To enable the students to learn about the

- Recent developments in furnishing, floor covering and other home textile products
- Various kinds of materials used in home textile.

#### **UNIT I HOME FURNISHING**

**9**

Development in Textile Furnishing – Type of Furnishing Materials – Woven and Nonwoven Selection of facilities – Colours – Design – Textile wall hanging – Cession Cussion covers – Kitchen Textile – Apron-Dish cloth – Bread Bag – Pot Holders – Table mats – Upholstery application : Fixed upholstery – Non-stretch loose covers – Stretchcovers.

#### **UNIT II FLOOR COVERINGS**

**9**

Recent development – Hand floor covering, Resilient Floor Soft floor Rugs, - Cushion and pads. Care – Tufted - Needle felt backing woven.. Woven carpet manufacture – wilton weaving, Shedding mechanism - Aximinister. Tufted carpet Manufacture – Broadloom machinery, Hand tufting, Thermo-bonded products Unconventional methods for making carpets – Bonding knitted carpet, Stitch bonding flocking.

#### **UNIT III CURTAINS AND DRAPERIES**

**9**

Advances in Home decoration – Draperies – Choice of Fabrics – Curtains – Developments in Finishing of Draperies – Developments in tucks and pleats - uses of Drapery Rods, Hooks, Tape Rings and pins. Table Textiles :- Table cloths – colour – Woven Printed, Jacquard , embroidered types, non-woven types. Table mats – Colour – Woven- Printed jacquard, Embroidered.

#### **UNIT IV BED LINERS**

**9**

Advances in the production –Different types: – Sheets – Blankets – Blanket Covers – Comforts – Comfort Covers – Bed Spreads – Mattress and Mattress Covers – Pads – Pillows. General: Hand / machine embroidered scarves - Stoles – Shawls – Madeups used in hospitals, Textiles care labeling Design aids.

**UNIT V TOWELS****9**

Types – Bath robes – Bead Towel – Kitchen Terry – Napkins. Construction : weave – Pile height - Pattern Dyeing and Finishing .Window Textile Sun Filters – Reflective textile .  
Velour Type of Velvet – Jacquard – Dodderly – Plain Pointed Manufacturing Methods – Construction.

**TOTAL : 45 PERIODS****OUTCOMES:**

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

- Know about different types of home textiles
- Understand the production method of different types of home textile products

**TEXT BOOKS:**

1. Wingate I.B., & Mohler J.E., Textile Fabrics & Their Selection, Prentice Hall Inc, New York, 1984.
2. Donserkery K.G., Interior Decoration in India, D.B. Taraporval Sons and Co. Pvt Ltd., 1973

**REFERENCE:**

1. Alexander N.G., Designing Interior Environment, Mass Court Brace Covanorich, Newyork, 1972.

**GE6083****DISASTER MANAGEMENT****L T P C****3 0 0 3****OBJECTIVES:**

- To provide students an exposure to disasters, their significance and types.
- To ensure that students begin to understand the relationship between vulnerability, disasters, disaster prevention and risk reduction
- To gain a preliminary understanding of approaches of Disaster Risk Reduction (DRR)
- To enhance awareness of institutional processes in the country and
- To develop rudimentary ability to respond to their surroundings with potential disaster response in areas where they live, with due sensitivity

**UNIT I INTRODUCTION TO DISASTERS****9**

Definition: Disaster, Hazard, Vulnerability, Resilience, Risks – Disasters: Types of disasters – Earthquake, Landslide, Flood, Drought, Fire etc - Classification, Causes, Impacts including social, economic, political, environmental, health, psychosocial, etc.- Differential impacts- in terms of caste, class, gender, age, location, disability - Global trends in disasters: urban disasters, pandemics, complex emergencies, Climate change- Dos and Don'ts during various types of Disasters.

**UNIT II APPROACHES TO DISASTER RISK REDUCTION (DRR)****9**

Disaster cycle - Phases, Culture of safety, prevention, mitigation and preparedness community based DRR, Structural- nonstructural measures, Roles and responsibilities of- community, Panchayati Raj Institutions/Urban Local Bodies (PRIs/ULBs), States, Centre, and other stakeholders- Institutional Processess and Framework at State and Central Level- State Disaster Management Authority(SDMA) – Early Warning System – Advisories from Appropriate Agencies.

**UNIT III INTER-RELATIONSHIP BETWEEN DISASTERS AND DEVELOPMENT****9**

Factors affecting Vulnerabilities, differential impacts, impact of Development projects such as dams, embankments, changes in Land-use etc.- Climate Change Adaptation- IPCC Scenario and Scenarios in the context of India - Relevance of indigenous knowledge, appropriate technology and local resources.

#### **UNIT IV        DISASTER RISK MANAGEMENT IN INDIA**

**9**

Hazard and Vulnerability profile of India, Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management, Institutional arrangements (Mitigation, Response and Preparedness, Disaster Management Act and Policy - Other related policies, plans, programmes and legislation – Role of GIS and Information Technology Components in Preparedness, Risk Assessment, Response and Recovery Phases of Disaster – Disaster Damage Assessment.

#### **UNIT V        DISASTER MANAGEMENT: APPLICATIONS AND CASE STUDIES AND FIELD WORKS**

**9**

Landslide Hazard Zonation: Case Studies, Earthquake Vulnerability Assessment of Buildings and Infrastructure: Case Studies, Drought Assessment: Case Studies, Coastal Flooding: Storm Surge Assessment, Floods: Fluvial and Pluvial Flooding: Case Studies; Forest Fire: Case Studies, Man Made disasters: Case Studies, Space Based Inputs for Disaster Mitigation and Management and field works related to disaster management.

**TOTAL: 45 PERIODS**

#### **OUTCOMES:**

The students will be able to

- Differentiate the types of disasters, causes and their impact on environment and society
- Assess vulnerability and various methods of risk reduction measures as well as mitigation.
- Draw the hazard and vulnerability profile of India, Scenarios in the Indian context,
- Disaster damage assessment and management.

#### **TEXTBOOKS:**

1. Singhal J.P. "Disaster Management", Laxmi Publications, 2010. ISBN-10: 9380386427 ISBN-13: 978-9380386423
2. Tushar Bhattacharya, "Disaster Science and Management", McGraw Hill India Education Pvt. Ltd., 2012. **ISBN-10:** 1259007367, **ISBN-13:** 978-1259007361]
3. Gupta Anil K, Sreeja S. Nair. Environmental Knowledge for Disaster Risk Management, NIDM, New Delhi, 2011
4. Kapur Anu Vulnerable India: A Geographical Study of Disasters, IAS and Sage Publishers, New Delhi, 2010.

#### **REFERENCES**

1. Govt. of India: Disaster Management Act , Government of India, New Delhi, 2005
2. Government of India, National Disaster Management Policy,2009.