

CURRICULUM

OF

TEXTILE ENGINEERING

BE/BS

Revised 2012



HIGHER EDUCATION COMMISSION

ISLAMABAD

CURRICULUM DIVISION, HEC

Prof. Dr. Syed Sohail H. Naqvi	Executive Director
Mr. Talat Khurshed	Adviser (Academics)
Malik Arshad Mahmood	Director (Curri)
Mr. Muhammad Arif	Deputy Director (Curri)
Mr. Farrukh Raza	Asst. Director (Curri)

Composed by: Mr. Zulfiqar Ali, HEC, Islamabad

Table of Content

1.	Introduction	6
2.	Rationale	8
3.	Goal	8
4.	Framework for BS/BE in Textile Engineering	10
5.	Scheme of Studies for BS/BE in Textile Engineering	15
6.	Courses Contents:- Humanities	16
7.	Course Contents:- Social Sciences	22
8.	Course Contents:- Management Sciences	37
9.	Course Contents:- Natural Sciences	43
10.	Course Contents:- Computing	50
11.	Course Contents:- Engineering Foundation	57
12.	Course Contents:- Major Based Core (Breadth)	65
13.	Course Contents:- Textile Engineering (Depth)	75
14.	Course Contents:- Inter-Disciplinary Engineering Breadth Elective	113
15.	Course Contents:- Senior Design Project	118

PREFACE

The curriculum of subject is described as a throbbing pulse of a nation. By viewing curriculum one can judge the stage of development and its pace of socio-economic development of a nation. With the advent of new technology, the world has turned into a global village. In view of tremendous research taking place world over new ideas and information pours in like of a stream of fresh water, making it imperative to update the curricula after regular intervals, for introducing latest development and innovation in the relevant field of knowledge.

In exercise of the powers conferred under Section 3, Sub-Section 2 (ii) of Act of Parliament No. X of 1976 titled “**Supervision of Curricula and Textbooks and Maintenance of Standard of Education**” the erstwhile University Grants Commission was designated as competent authority to develop, review and revise curricula beyond Class-XII. With the repeal of UGC Act, the same function was assigned to the Higher Education Commission under its Ordinance of 2002, Section 10, Sub-Section 1 (v).

In compliance with the above provisions, the HEC undertakes revamping and refurbishing of curricula after regular intervals in a democratic manner involving universities/DAIs, research and development institutions and local Chamber of Commerce and Industry. The intellectual inputs by expatriate Pakistanis working in universities and R&D institutions of technically advanced countries are also invited to contribute and their views are incorporated where considered appropriate by the National Curriculum Revision Committee (NCRC).

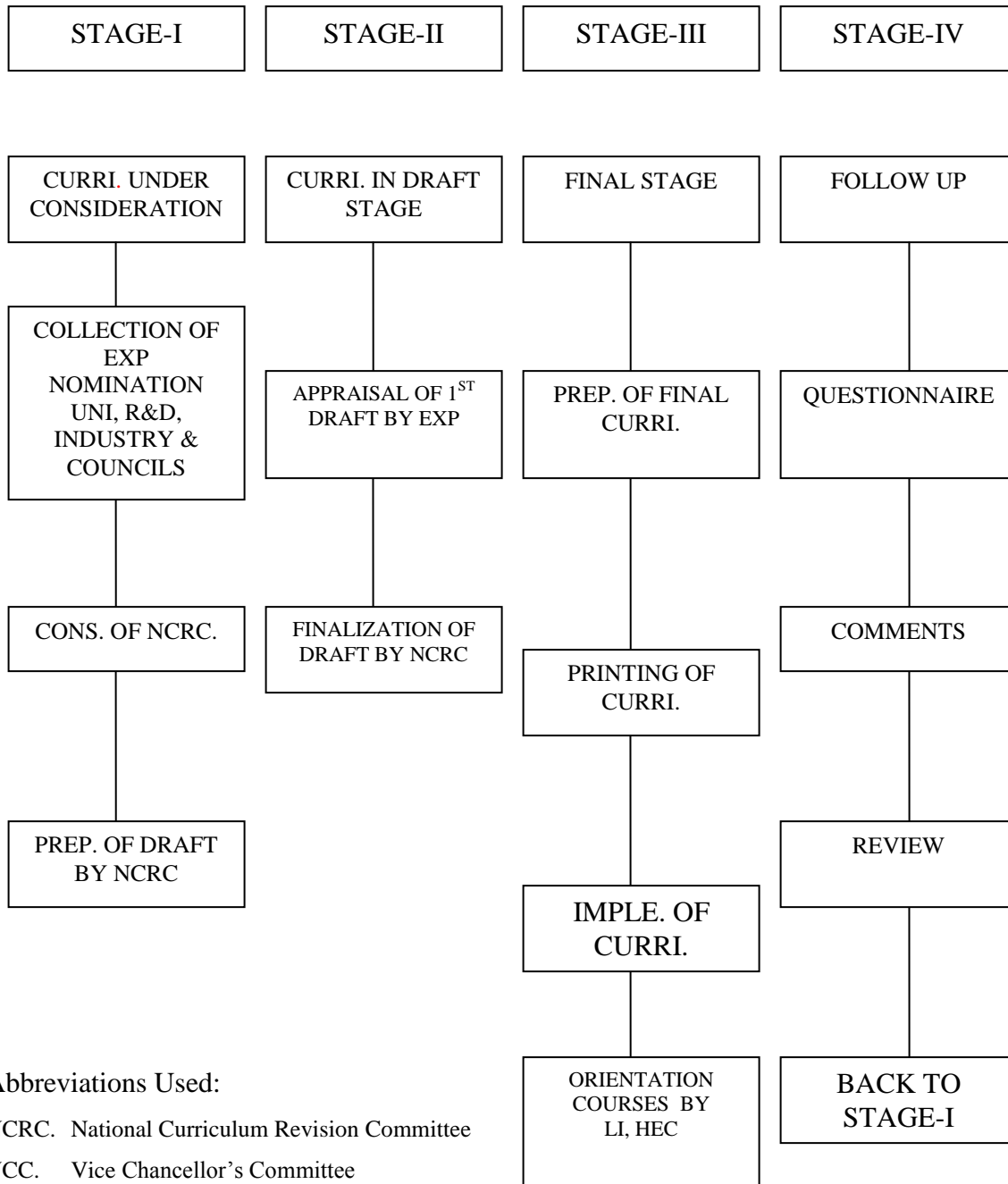
A committee of experts comprising of conveners from the National Curriculum Revision Committees of HEC in the disciplines of Basic, Applied, Social Sciences, Agriculture and Engineering met in 2007 & 2009 and developed the unified templates to standardize degree programmes in the country so as to bring the national curriculum at par with international standards, and to fulfill the national needs. It also aimed to give a basic, broad based knowledge to the students to ensure the quality of education.

In line with above, NCRC comprising senior university faculty and experts from various stakeholders and the respective accreditation councils has finalized the curriculum for Textile Engineering. The same is being recommended for adoption by the universities/DAIs channelizing through relevant statutory bodies of the universities.

TALAT KHURSHID
Adviser (Academics)

May, 2012

CURRICULUM DEVELOPMENT



Abbreviations Used:

- NCRC. National Curriculum Revision Committee
- VCC. Vice Chancellor's Committee
- EXP. Experts
- COL. Colleges
- UNI. Universities
- PREP. Preparation
- REC. Recommendations
- LI Learning Innovation
- R&D Research & Development Organization
- HEC Higher Education Commission

Introduction

The final meeting of National Curriculum Revision Committee (NCRC) for Textile Engineering was held on April 17-19, 2012 at HEC Regional Centre, Karachi to finalize the draft curriculum BE/BS Textile Engineering prepared earlier on December 19-21, 2011 at the same venue. The following attended the final meeting of NCRC for Textile Engineering:

Dr. Mumtaz Hasan Malik
Dean Academics
National Textile University
Faisalabad.

Convener

Dr. Khalid Pasha
Professor & Chairman
Department of Textile Engineering
NED University of Engineering & Technology
Karachi.

Member/Secretary

Dr. Tanveer Hussain
Dean, Faculty of Engineering & Technology
National Textile University
Faisalabad.

Member

Dr. Hafiz ur Rahman
Professor, Emeritus
Textile Institute of Pakistan
Karachi.

Member

Dr. Faheem ud Din
Professor & Chairman
Department of Textile Engineering
Balochistan University of Information Technology,
Engineering & Management Sciences
Quetta.

Member

Dr. Sheraz Hussain Siddique
Associate Professor
Department of Textile Engineering
NED University of Engineering & Technology
Karachi.

Member

Dr. Assad Farooq
Assistant Professor
Department of Fiber & Textile Technology
University of Agriculture
Faisalabad.

Member

Dr. Mazhar Hussain Peerzada Assistant Professor Department of Textile Engineering Mehran University of Engineering & Technology Jamshoro.	Member
Dr. Awais Khatri Assistant Professor Department of Textile Engineering Mehran University of Engineering & Technology, Jamshoro.	Member
Mr. Muhammad Asghar Siddiqui Lecturer School of Textile Engineering The University of Faisalabad Faisalabad.	Member
Mr. Tallal Khan HOD/Programme Coordinator Textile Design Department Pakistan Institute of Fashion & Design Lahore.	Member

The meeting started with the recitation from the Holy Quran by Dr. Mazhar Hussain Peerzada. Mr. Talat Khurshid, Adviser (Acad.), HEC welcomed the participants and briefed about the earlier meeting of NCRC. He informed the participants on the aim and objectives of the meeting with a particular focus on revising the course outlines of BE/BS (4-year) Textile Engineering so as to make it compatible with international standards and demands as well as ensuring the uniformity of academic standard within the country. The Adviser (Acad.) then requested Dr. Mumtaz Hassan Malik, the Convener of the Committee, to conduct proceedings of all technical sessions of meeting for three days.

In the concluding session, the National Curriculum Revision Committee for Textile Engineering agreed to recommend the scheme of studies for BE/BS Textile Engineering. The Committee also gave its recommendations for enhancing the overall academic standard of textile engineering students by providing the best possible teaching aids and laboratory facilities along with the highly qualified and well experienced faculty of engineering and non-engineering subjects to be taught in the programme.

Rationale:

Textile is the largest industrial sector of Pakistan accounting for more than 55% of our national exports. Over the last couple of decades the face of textiles has changed dramatically all over the world. Textile is no longer a

commodity industry but it involves manufacturing of very high-tech products including but not limited to: development of the strongest fibre ever known to man, development of nano-composite material, development of new bio-compatible materials, development of high-performance fabrics, development of protective textiles and development of self-cleaning fabrics, etc.

The Committee has made its sincere efforts to incorporate the current and future requirements of textile industry while revising the curriculum of textile engineering. However, it must be emphasized that it is not only the contents of curriculum that is important but also the process by which it is delivered to the students. Even the best developed curriculum cannot bear good fruits if it is not combined with good teaching methodologies.

Goals:

This proposed curriculum is aimed at providing students with a broad-based education and creating in them the ability to innovate and design new textile products and processes. In the delivery of this curriculum, every effort should be made to pass on the students not just the technical information but impart real knowledge with critical and creative thinking, analytical reasoning and problem-solving skills.

Another aim of this curriculum is to teach students the human skills along with the technical skills so as to enhance not only their technical intelligence but also their social intelligence in order to make them good and productive human beings. The curriculum is based on the concept of foundation, breadth and depth courses so that streams for different specializations can be created.

Foundation Courses:

The foundation courses are the courses that all students in a given discipline of engineering must take. These courses provide students with the fundamental concepts and tools to pursue their studies at the higher level.

Breadth Courses:

The breadth courses introduce students to different specialties in the given discipline of engineering early in their studies. Before taking the breadth courses, students should be advised that their choices will affect taking follow up courses.

Depth Courses:

The depth courses offer specialization within each engineering discipline. All depth courses must integrate a substantial design component. The students may select electives from any of the areas of specialization with guidelines from their respective advisers.

General Objectives of the Programme:

The main objective of textile engineering programme is to make the textile engineering graduate a creative problem-solver using latest tools of engineering to design novel, functional textiles and processes. The emphasis is on process and product development using textile materials. The graduates will have knowledge in traditional textile manufacturing as well as in technical textiles. The graduates will be able to analyze structure property relationships of textile materials, develop and characterize novel textiles including woven, knitted and non-woven structures. The graduates will have the ability to pursue post-graduate studies with a strong knowledge gained in the fundamentals of mathematics, physics, chemistry, engineering subjects and research skills developed through project work.

Learning Outcomes:

On completion of the BE/BS Textile Engineering programme, graduates will:

1. have a solid foundation in basic sciences and engineering fundamentals and will be able to apply this knowledge to the solution of practical problems.
2. be able to demonstrate the ability to design and develop useful textile-related products, processes, and/or other systems.
3. be able to demonstrate the ability to design and conduct experiments and analyze and interpret data related to problem solving in the areas encompassed by textile engineering.
4. be able to work in teams and appreciate the value of diversity in team-based problem solving.
5. have commitment to life-long learning and an ability to adapt to changes and developments in the field of textiles.
6. demonstrate integrity and ethics in engineering practice and in life.
7. demonstrate the ability to communicate effectively.
8. have a broad-based educational background enabling them to pursue careers within or outside of textile engineering.

FRAMEWORK FOR BE/BS TEXTILE ENGINEERING

Duration	4 years
Number of semesters	8
Number of weeks per semester	16 - 18 (16 for teaching and 2 for examinations)
Duration of each class	1 lecture credit = 1 hour, 1 lab credit = 3hours
Total number of credit hours	136
Number of credit hours per semester	15-18
Engineering Courses	65-70 %
Non-Engineering Courses	30-35 %

Non-Engineering Domain								
Knowledge Area	Course Name	LEC	LAB	CR	Total Courses	Total Credits	Area wise %	Overall %
Humanities	Functional English	3	0	3	5	13	28.26	9.55
	Communication & Presentation Skills	3	0	3				
	Technical Writing	3	0	3				
	Islamic Studies	2	0	2				
	Pakistan Studies	2	0	2				
Social Sciences	Social Science-I	3	0	3	2	6	13.04	4.41
	Social Science-II	3	0	3				
Management Sciences	Management Science-I	3	0	3	2	6	13.04	4.41
	Management Science-II	3	0	3				
Natural Sciences	Calculus-I	3	0	3	6	21	45.65	15.45
	Calculus-II	3	0	3				
	Calculus-III	3	0	3				
	Physics-I	3	1	4				
	Chemistry-I	3	1	4				
	Physics-II /Chemistry-II	3	1	4				
Sub Total		43	3	46	15	46	100	33.82

Engineering Domain								
Knowledge Area	Course Name	LEC	LAB	CR	Total Courses	Total Credits	Area wise %	Over all %
Computing	Introduction to Computers	2	1	3	3	9	10.0	6.61
	Computer Programming	2	1	3				
	Computer Application in Engineering Design	1	2	3				
Engineering Foundation	Introduction to Textile Engineering	2	0	2	8	23	25.55	16.91
	Textile Raw Materials	4	0	4				
	Fibre Science	2	1	3				
	Mechanics of Fibrous Structures	2	1	3				
	High Performance Fibers	2	0	2				
	Environmental Issues of Textile Industry	2	1	3				
	Textile Eng. Utilities & Services	3	0	3				
	Statistical Methods in Textile Eng.	3	0	3				
Major-based Core (Breadth)	Polymer Science & Eng.	3	0	3	6	22	24.44	16.17
	Introduction to Yarn Manufacturing	3	1	4				
	Introduction to Fabric Manufacturing	3	1	4				
	Introduction to Textile Chemical Processing	3	1	4				
	Introduction to Garment Manufacturing	3	1	4				
	Color Science	2	1	3				
Major-based Core (Depth)	Engineering Elective-I	2	1	3	6	20	22.22	14.70
	Engineering Elective-II	3	1	4				
	Engineering Elective-III	3	1	4				
	Engineering Elective-IV	2	1	3				
	Engineering Elective-V	2	1	3				
	Engineering Elective-VI	2	1	3				
Inter-Disciplinary Engineering (Breadth)	Mechanical Engineering Fundamentals	2	1	3	4	9	10.0	6.61
	Electrical & Electronic Eng. Fundamentals	2	1	3				
	Eng. Drawing	0	1	1				
	Instrumentation & Control	2	0	2				

Senior Design Project	Senior Design Project-I	0	3	3	2	6	6.66	4.41
	Senior Design Project-II	0	3	3				
Industrial Training 4-6 weeks in Summer						1	1.11	0.73
Total		62	27	89	29	90	100	66.18
Grand Total		105	30	135	44	136		100

Summary:

Domain	Knowledge Area	Total Course	Total Credits	% Overall
Non-Engineering	Humanities	5	13	33.82
	Social Sciences	2	6	
	Management Sciences	2	6	
	Natural Sciences	6	21	
	Sub Total	15	46	
Engineering	Computing	3	9	66.18
	Engineering Foundation	8	23	
	Major-based Core (Breadth)	6	22	
	Major-based Core (Depth)	6	20	
	Inter-Disciplinary	4	9	
	Senior Design Project	2	6	
	Industrial Training (Summer)	0	1	
	Sub Total	29	90	
Total		44	136	100

Engineering Foundation Courses:

1. Introduction to Textile Engineering	(2 0 2)
2. Engineering Foundation-I: Textile Raw Materials	(4 0 4)
3. Engineering Foundation-II: Fibre Science	(2 1 3)
4. Engineering Foundation-III: Mechanics of Fibrous Structures	(2 1 3)
5. Engineering Foundation-IV: High-Performance Fibers	(2 0 2)
6. Engineering Foundation-V: Environmental Issues of Textile Industry	(2 1 3)
7. Engineering Foundation-VI: Textile Engineering Utilities & Services	(3 0 3)
8. Statistical Methods in Textile Engineering	(2 1 3)
Total	(19 4 23)

Engineering Major-based Breadth Courses

1. Breadth-I: Polymer Science and Engineering	(3 0 3)
2. Breadth-II: Introduction to Yarn Manufacturing	(3 1 4)
3. Breadth-III: Introduction to Fabric Manufacturing	(3 1 4)
4. Breadth-IV: Introduction to Textile Chemical Processing	(3 1 4)
5. Breadth-V: Introduction to Garment Manufacturing	(3 1 4)
6. Breadth-VI Color Science	(2 1 3)
Total	(17 5 22)

Engineering Major-based Depth Courses

1. Engineering Elective-I: Pre-spinning processes-I/Weaving Preparatory Processes/Pre-treatment of Textiles/Garment Sizing and Pattern Making
2. Engineering Elective-II: Pre-spinning Processes-II/Weaving Mechanisms/ Dyestuff Engineering /Industrial Cutting and Sewing
3. Engineering Elective-III: Yarn Production Engineering/Fabric Structures & Design/ Textile Dyeing/ Garment Production Machinery
4. Engineering Elective-IV: Advanced Spinning Techniques/Advanced Weaving/Textile Printing/ Industrial Engineering in Garment Manufacturing
5. Engineering Elective-V: Spinning Calculations/Weaving Calculations/Textile Finishing /Advances in Apparel Production
6. Engineering Elective-VI: Specialty Yarns/Specialty Weaving/Textile Coating/Apparel Merchandising and Sourcing

Inter-Disciplinary Engineering Courses

1. Mechanical Engineering Fundamentals	(2 1 3)
2. Engineering Drawing	(0 1 1)
3. Electrical & Electronic Engineering Fundamentals	(2 1 3)
4. Instrumentation and Control	(2 0 2)
Total	(6 3 9)

Electives for Specialization in Yarn Manufacturing

1. Pre-spinning Processes-I	(2 1 3)
2. Pre-spinning Processes-II	(2 1 3)
3. Yarn Production Engineering	(3 1 4)
4. Advanced Spinning Techniques	(2 1 3)
5. Spinning Calculations	(3 1 4)
6. Specialty Yarns	(3 0 3)
Total	(15 5 20)

Electives for Specialization in Fabric Manufacturing

1. Weaving Preparatory Processes	(2 1 3)
2. Weaving Mechanisms	(3 1 4)
3. Fabric Structure and Design	(3 1 4)
4. Advanced Weaving	(2 1 3)
5. Weaving Calculations	(3 0 3)
6. Specialty Weaving	(2 1 3)
Total	(15 5 20)

Electives for Specialization in Textile Chemical Processing

1. Pre-treatment of Textiles	(2 1 3)
2. Dyestuff Engineering	(2 1 3)
3. Textile Dyeing	(3 1 4)
4. Textile Printing	(3 1 4)
5. Textile Finishing	(3 1 4)
6. Textile Coating	(2 0 2)
Total	(15 5 20)

Electives for Specialization in Garment Manufacturing

1. Garment Sizing and Pattern Making	(3 1 4)
2. Industrial Cutting and Sewing	(2 1 3)
3. Garment Production Machinery	(3 1 4)
4. Industrial Engineering in Garment Manufacturing	(2 1 3)
5. Advances in Apparel Production	(2 1 3)
6. Apparel Merchandising and Sourcing	(3 0 3)
Total	(15 5 20)

In addition to the above specializations, the universities may also offer other specializations in areas like Knitting, Nonwovens, Technical Textiles, Textile Materials, Textile Machine Design, Textile Information Systems Design, Textile Composites etc.

The list of practical given against each course serves as guideline. Universities may adopt other relevant practical according to course content and available laboratory facility.

SCHEME OF STUDIES BE/BS TEXTILE ENGINEERING

COURSE TITLE	LEC	LAB	CR	COURSE TITLE	LEC	LAB	CR
First Year							
Introduction to Textile Eng.	2	0	2	Textile Raw Materials	4	0	4
Functional English	3	0	3	Introduction to Computers	2	1	3
Calculus-I	3	0	3	Calculus-II	3	0	3
Chemistry-I	3	1	4	Physics-II/ Chemistry-II	3	1	4
Physics-I	3	1	4	Engineering Drawing	0	1	1
Pak Studies	2	0	2	Fiber Science	2	1	3
Total	16	2	18	Total	14	4	18
First Year Credits	36						
Second Year							
Introduction to Yarn Manufacturing	3	1	4	Engineering Elective-I*	2	1	3
Introduction to Fabric Manufacturing	3	1	4	Electrical & Electronic Eng. Fundamentals	2	1	3
Introduction to Textile Chemical Processing	3	1	4	Mechanical Engineering Fundamentals	2	1	3
Introduction to Garment Manufacturing	3	1	4	Polymer Science & Eng.	3	0	3
Islamic Studies	2	0	2	Communication & Presentation Skills	3	0	3
				Calculus-III	3	0	3
Total	14	4	18	Total	15	3	18
Second Year Credits	36						
Third Year							
Engineering Elective-II*	3	1	4	Engineering Elective-III*	3	1	4
Technical Writing	3	0	3	Engineering Elective-IV*	2	1	3
High-Performance Fibers	2	0	2	Mechanics of Fibrous Structures	2	1	3
Computer Programming	2	1	3	Textile Egg. Utilities & Services	3	0	3
Social Science-I	3	0	3	Computer Applications in Engineering Design	1	2	3
Instrumentation & Control	2	0	2				
Total	15	2	17	Total	11	5	16
Third Year Credits	34						
Fourth Year							
Engineering Elective-V	2	1	3	Engineering Elective-VI	2	1	3
Senior Design Project-I	0	3	3	Senior Design Project-II	0	3	3
Color Science	2	1	3	Management Science-II	3	0	3
Statistical Methods in Textile Engineering	3	0	3	Environmental Issues of Textile Industry	2	1	3
Management Science - I	3	0	3	Social Science-II	3	0	3
Total	10	5	15	Total	10	5	15
Fourth Year Credits	30						
Industrial Internship (4 weeks, 6 days/week, 8 hours/day during summer holidays)							1
Total Credits	136						

COURSE CONTENTS – HUMANITIES

- 1. Functional English**
- 2. Communication & Presentation Skills**
- 3. Technical Writing**
- 4. Islamic Studies**
- 5. Pakistan Studies**

1. Functional English (3 0 3)

Objectives:

- To develop grammatical competence of the learners to become proficient writers and speakers of English.

Course Contents:

1. Basics of Grammar
2. Parts of speech and use of articles
3. Sentence structure, active and passive voice
4. Practice in unified sentence
5. Analysis of phrase, clause and sentence structure
6. Transitive and intransitive verbs
7. Punctuation and spelling

Module 1 Reading and Comprehension

- Comprehending the text from textile books and articles; and answering questions based on them.

Module 2 Discussion

- General topics and every day conversation (topics for discussion to be at the discretion of the teacher keeping in view the level of students)

Module 3 Listening Comprehension

- To be improved by showing documentaries/films carefully selected by subject teachers)

Module 4 Translation Skills

- Urdu to English & English to Urdu

Module 5 Paragraph Writing

- Topics to be chosen at the discretion of the teacher

Module 6 Presentation Skills

- Introduction

Recommended Books:

1. Practical English Grammar by A. J. Thomson and A. V. Martinet. Exercises 1& 2. Third edition. Oxford University Press. 1997.
2. Writing. Intermediate by Marie-Christine Boutin, Suzanne Brinand and Françoise Grellet. Oxford Supplementary Skills. Fourth Impression 1993.
3. Reading. Upper Intermediate. Brian Tomlinson and Rod Ellis. Oxford Supplementary Skills. Third Impression 1992.
4. Principles and types of speech communication by Gronbeck, B. E. et al., latest ed.

2. Communication & Presentation Skills (3 0 3)

Objectives:

- To enable students to become proficient in oral and written communication.

Course Contents:

Module 1 Paragraph Writing

- Practice in writing a good, unified and coherent paragraph

Module 2 Essay Writing

- Introduction

Module 3 CV and Job Application

Module 4 Study Skills

- Skimming and scanning, intensive and extensive, and speed reading, summary and precise writing and comprehension

Module 5 Academic Skills

- Letter / memo writing and minutes of the meeting, use of library and internet resources

Module 6 Presentation Skills

- Personality development (emphasis on content, style and pronunciation), presentation techniques including collecting and managing material, making and using visual aids, handling questions and audiences, attention getting techniques, personal management, persuasive communication.

Module 7 Handling Business Meetings

- Agenda writing, minutes of the meeting, recording and presenting the minutes, successful written and oral presentation,

Recommended Books:

1. Practical English Grammar by A. J. Thomson and A. V. Martinet. Exercises 2. Third edition. Oxford University Press 1986
2. Writing. Intermediate by Marie-Christine Boutin, Suzanne Brinand and Françoise Grellet. Oxford Supplementary Skills. Fourth Impression 1993.

3. Upper-Intermediate by Rob Nolasco. Oxford Supplementary Skills. Fourth Impression 1992
4. Reading. Advanced. Brian Tomlinson and Rod Ellis. Oxford Supplementary Skills. Third Impression 1991.
5. Reading and Study Skills by John Langan
6. Study Skills by Richard York.
7. Writing on the job, by Cosmo F. Ferrara, latest edition
8. Effective Communication, by Murphy, Prentice-Hall, latest ed.

3. Technical Writing (3 0 3)

Objectives:

- To improve student's technical writing skills.

Course Contents:

Module 1 Essay Writing

- Descriptive, narrative, discursive, argumentative

Module 2 Academic Writing

- How to write a proposal for research paper/term paper.
- How to write a research paper/term paper (emphasis on style, content, language, form, clarity, consistency).

Module 3 Technical Report Writing

Module 4 Progress Report Writing

Recommended Books:

1. Writing. Advanced by Ron White. Oxford Supplementary Skills. Third Impression 1992.
2. College Writing Skills by John Langan. McGraw-Hill Higher Education. 2004.
3. Patterns of College Writing (4th edition) by Laurie G. Kirszner and Stephen R. Mandell. St. Martin's Press.
4. The Mercury Reader. A Custom Publication. Compiled by northern Illinois University. General Editors: Janice Neulib; Kathleen Shine Cain; Stephen Ruffus and Maurice Scharon.
5. Johnson-Sheehanl, Richard. (2004). Technical Communication Today. Longman.
6. Markel, Mike. (1996). Technical Communication Essentials. Martin's Press, Inc.

4. Islamic Studies (2 0 2)

Objectives:

- To develop in students understanding of contemporary social, political and economic issues in the light of the Quran and Sunnah of the Holy Prophet (S.A.W)

Course Contents:

Module 1 Introduction to Quranic Studies

- Basic Concepts of Quran
- History of Quran
- Uloom-ul-Quran
- Quran as a book of Guidance

Module 2 Study of Selected Text of Holly Quran

- Verses of Surah Al-Baqara Related to Faith (Verse No-284-286)
- Verses of Surah Al-Hujrat Related to Adab Al-Nabi (Verse No-1-18)
- Verses of Surah Al-Mumanoon Related to Characteristics of faithful (Verse No-1-11)
- Verses of Surah al-Furqan Related to Social Ethics (Verse No.63-77)
- Verses of Surah Al-Inam Related to Ihkam (Verse No-152-154)

Module 3 Study of Selected Text of Holly Quran

- Verses of Surah Al-Ihزاب Related to Adab al-Nabi (Verse No.6,21,40,56,57,58.)
- Verses of Surah Al-Hashar (18,19,20) Related to thinking, Day of Judgment
- Verses of Surah Al-Saf Related to Tafakar,Tadabar (Verse No-1,14)

Module 4 Seerat of Holy Prophet (S.A.W) - I

- Life of Muhammad Bin Abdullah (Before Prophet Hood)
- Life of Holy Prophet (S.A.W) in Makkah
- Important Lessons Derived from the life of Holy Prophet in Makkah

Module 5 Seerat of Holy Prophet (S.A.W) - II

- Life of Holy Prophet (S.A.W) in Madina
- Important Events of Life of Holy Prophet in Madina
- Important Lessons Derived from the life of Holy Prophet in Madina

Module 6 Introduction to Sunnah

- Basic Concepts of Hadith
- History of Hadith
- Kinds of Hadith
- Uloom-ul-Hadith
- Sunnah & Hadith
- Legal Position of Sunnah

Module 7 Selected Studies from Text of Hadith

Module 8 Introduction to Islamic Law & Jurisprudence

- Basic Concepts of Islamic Law & Jurisprudence
- History & Importance of Islamic Law & Jurisprudence
- Sources of Islamic Law & Jurisprudence
- Nature of Differences in Islamic Law
- Islam and Sectarianism

Module 9 Islamic Culture & Civilization

- Basic Concepts of Islamic Culture & Civilization

- Historical Development of Islamic Culture & Civilization
- Characteristics of Islamic Culture & Civilization
- Islamic Culture & Civilization and Contemporary Issues

Module 10 Islam & Science

- Basic Concepts of Islam & Science
- Contributions of Muslims in the Development of Science
- Quran & Science

Module 11 Islamic Economic System

- Basic Concepts of Islamic Economic System
- Means of Distribution of wealth in Islamic Economics
- Islamic Concept of Riba
- Islamic Ways of Trade & Commerce

Module 12 Political System of Islam

- Basic Concepts of Islamic Political System
- Islamic Concept of Sovereignty
- Basic Institutions of Govt. in Islam

Module 13 Islamic History

- Period of khlaft-e-rashida
- Period of ummayyads
- Period of abbasids

Module 14 Social System of Islam

- Basic concepts of social system of Islam
- Elements of family
- Ethical values of Islam

Recommended Books:

1. Emergence of Islam by Hameed Ullah Muhammad, IRI, Islamabad
2. Muslim Conduct of State by Hameed Ullah Muhammad
3. Introduction to Islam by Hameed Ullah Muhammad, Mulana Muhammad Yousaf islahi,"
4. An Introduction to the Study of Islamic Law by Hussain Hamid Hassan, leaf Publication Islamabad, Pakistan.
5. Principles of Islamic Jurisprudence by Ahmad Hasan, Islamic Research Institute, Islamabad 1993.
6. Muslim Jurisprudence and the Quranic Law of Crimes by Mir Waliullah, Islamic Book Service, 1982
7. Studies in Islamic Law, Religion and Society by H.S. Bhatia, Deep & Deep Publications, India, 1989
8. Introduction to Al Sharia Al Islamia by Dr. Muhammad Zia-ul-Haq, Allama Iqbal Open University, Islamabad, 2001

5. Pakistan Studies

(2 0 2)

Objectives:

- To develop in students an understanding of historical perspective and ideological background of Pakistan as well as contemporary social, political and economic issues.

Course Contents:

Module 1 Historical Perspective

- Ideological rationale with special reference to Sir Syed Ahmed Khan, Allama Muhammad Iqbal and Quaid-e-Azam Muhammad Ali Jinnah.
- Factors leading to Muslim separatism
- People and Land
- Indus Civilization
- Muslim advent
- Location and Geo-Physical features.

Module 2 Government and Politics in Pakistan

Political and constitutional phases:

- 1947-58
- 1958-71
- 1971-77
- 1977-88
- 1988-99
- 1999 onward

Module 3 Contemporary Pakistan

- Economic institutions and issues
- Society and social structure
- Ethnicity
- Foreign policy of Pakistan and challenges
- Futuristic outlook of Pakistan

Recommended Books:

1. State & Society in Pakistan by Burki, Shahid Javed, The Macmillan Press Ltd. 1980.
2. Issue in Pakistan's Economy by Akbar, S. Zaidi, Oxford University Press, 2000.
3. Pakistan's Foreign policy: An Historical Analysis by S. M. Burke and Lawrence Ziring, Oxford University Press, 1993.
4. Pakistan Political Roots & Development by Mehmood, Safdar..Lahore, 1994.
5. The Emergence of Bangladesh by Wilcox, Wayne, American Enterprise, Institute of Public Policy Research, 1972.
6. Pakistan Kayyun Toota by Mehmood, Safdar, Idara-e-Saqafat-e-Islamia, Lahore.

7. National Movement in Pakistan by Amin, Tahir. Ethno Institute of Policy Studies, Islamabad.
8. Enigma of Political Development by Ziring, Lawrence. Wm Dawson & sons Ltd, 1980.
9. History & Culture of Sindh by Zahid, Ansar, Royal Book Company, 1980.
10. Political Parties in Pakistan by Afzal, M. Rafique., National Institute of Historical and Cultural Research, 1998.
11. The Political System of Pakistan by Sayeed, Khalid Bin, 1967.
12. Politics in Pakistan by Aziz, K. K. National Commission on Historical and Cultural Research, 1976.
13. Pakistan under Martial Law by Muhammad Waseem, Vanguard, 1987.
14. Making of Pakistan by Haq, Noor ul, National Commission on Historical and Cultural Research, 1993.

COURSE CONTENTS – SOCIAL SCIENCES

- 1. Social Science–I**
- 2. Social Science–II**

Note: The following courses should be considered as guidelines. Universities may also offer any other two introductory social science courses of their choice.

1. Sociology & Development (3 0 3)

Objectives:

- To apprise potential engineers about social factors that contribute towards enhancing their professional performance for the good of society and the country.
- To enhance understanding about the determinants of human behavior, which ultimately will result in improved individual efficiency.

Course Contents:

Module 1 Introduction to Sociology

- What is sociology?
- Nature, Scope, and Importance of Sociology
- Social Interactions
- Social Groups
- Social Institutions

Module 2 Culture and Related Concepts

- Definition of Culture
- Types of Culture
- Elements of Culture

- Role of Culture in Organization
- Socialization and Personality

Module 3 Interpersonal Relations

- Interpersonal Behaviour
- Formation of Personal Attitudes
- Language and Communication
- Motivations and Emotions
- Public Opinion

Module 4 Social Stratification

- Factors of Social Stratification
- Caste and class
- Power, Prestige, and Authority
- Social Mobility
- Migration

Module 5 Human Ecology

- Ecological Processes
- Ecosystem and energy
- Ecosystem and Physical Environment
- Solid Waste Disposal
- Pollution

Module 6 Population Dynamics

- World Population Growth and Distribution
- Population Dynamics in Pakistan
- Causes and Consequences of Urbanization
- Population Policy in Pakistan
- Population and Development

Module 7 Community Development

- Meaning, Scope, and Subject Matter of Community Development
- Processes of Community Development
- Community Development Programmes in Pakistan
- Community Organization and Related Services
- Cooperation and Conflict in Community Development

Module 8 Deviance and Crime

- Crime as a Social and Cultural Phenomenon
- Crime and Social Organization
- Organized Crime
- Culture Based Crime
- Economics of Crime

Module 9 Sociology of Change and Development

- What is Social Change and Development?
- Dynamics of Social Change
- Role of NGOs in Development
- World System and Development
- Gender and Development

Recommended Books:

1. The Historical Background of Modern Social Psychology by Allport, G. W. New York, Random House. 1985.
2. Sociology by A. Bernard and T. Burgess, Cambridge University Press. 2004.
3. Human Relations: Interpersonal Job Oriented Skills by A. J. Du Brin, New York, Prentice Hall. 2007.
4. Understanding Pakistan by Gardezi, H. N: The Colonial Factor in Societal Development. Lahore, Maktaba Fikr-o-Danish, 1991.
5. Changing Pakistan Society by Hafeez, S. Royal Book Company. Gardezi, H. N., Ed. 1991.

2. Social Anthropology

(3 0 3)

Objectives:

- To impart knowledge of social anthropology from social, cultural and industrial perspective.

Course Contents:

Module 1 Introduction

- Anthropology and Social Anthropology
- Fields of Anthropology
- Anthropological Research Methods
- Social Anthropology and other Social Sciences
- Significance of Social Anthropology

Module 2 Culture

- Definition, Properties and Taxonomy
- Evolution of Growth and Culture
- Evolution of Man: Religious and Modern Perspectives
- Evolution of Culture
- Culture and Personality

Module 3 Evolution and Growth of Culture

- Evolution of Man
- Schools of Thought in Cultural Anthropology
- Acculturation
- Enculturation
- Ethnocentrism and Xenocentrism

Module 4 Language and Culture

- Communication
- Structural Linguistics
- Historical Linguistics
- Relationship between Language and Culture
- Ethnography

Module 5 Economic System

- Global Economic System
- The Allocation of Resources
- The Conversion of Resources
- The Distribution of Goods and Services
- Poverty and Inequality

Module 6 Marriage and Family

- Marriage and Mate Selection
- The Family: Types and Functions
- Kinship System
- Structure and Function of Family
- Gender Relations

Module 7 Political Organization

- Political Sociology
- Origin of Political Organization and Organizational System
- Types of Political Organizations
- Power Politics and Factionalism in Pakistan
- Resolution of Conflict

Module 8 Religion and Magic

- The Universality of Religion
- Comparative Religions
- Religion and Society
- Religious Beliefs and Practices
- Witchcraft and Sorcery

Module 9 Culture Change

- Forms of Art
- Expressive Culture
- Process of Cultural Change
- Cultural Change in the Modern World
- Cultural Change in Pakistani society

Recommended Books:

1. Pakistani Society by Ahmad, Akbar S. Karachi, Royal Books Co. 1990.
2. Research Methods in Anthropology, Qualitative and Quantitative Approaches, by Bernard, H. Russel. London: Sage Publications, 1994.
3. Cultural Anthropology, California by Bodley, John H. Mayfield Publishing Co. 1994
4. Social Anthropology and the Lonely Crowd by Brogger, New Delhi: Reliance Publishing. 1993
5. Anthropology, 11th Ed. by Ember, Carol R. & Ember Melvin. Englewood Cliffs: Prentice Hall, Inc. Harper and Row, 2005

3. Understanding Psychology and Human Behaviour

(3 0 3)

Objectives:

- To develop an understanding of psychology vis-à-vis human behavior in different social and professional settings

Course Contents:

Module 1 What is Psychology?

Module 2 Nature, Scope and Application with Special Reference to Pakistan

Module 3 Different Schools of Psychology

Module 4 Methods of Psychology

Module 5 Learning

Module 6 Intelligence and Artificial Intelligence

Module 7 Personality and its Assessment

Module 8 Understanding Maladjustive Behavior

Module 9 Positive Emotional States and Processes

Module 10 Stress Management and Anger Management

Recommended Books:

1. Introduction to Psychology (13th Ed.) by Atkinson R. C., & Smith E. E., Harcourt Brace College Publishers. 2000.
2. Introduction to Psychology by Fernald, L. D., & Fernald, P. S. USA: WMC Brown Publishers. 2005.
3. An Introduction to the History of Psychology, by B. R. Hergenhahn, New York: Wadsworth. 2001.
4. Research in Psychology: Methods and Design, (3rd Ed.) by C. J. Goodwin, New York: John Wiley & Sons. 2000.
5. Positive Psychology by Synder, C. R., & Lopez, S. J., USA, Sage Publications. 2007.

4. Professional Psychology

(3 0 3)

Objectives:

- To develop in students an understanding of psychology from different professional perspectives.

Course Contents:

Module 1 Introduction to Professional Psychology

Module 2 Psychological Testing

Module 3 Educational Psychology

Module 4 Industrial/Organizational Psychology

Module 5 Social Psychology

Module 6 Health Psychology

Module 7 Clinical Psychology

Module 8 Positive Psychology

Module 9 Legal, Ethical, and Professional Issues

Recommended Books:

1. Educational Psychology by Crow, L., & Crow, A. New Delhi: Eurasia Publishing House Ltd. 2000.
2. Ethics in Psychology by Spiegel, P. K., & Koocher, G. P., New York: Oxford University Press 1998.
3. Handbook of Positive Psychology by Snyder, C. R., & Lopes, S. J. New York: Oxford University Press. 2000.
4. Introduction to Positive Psychology by Compton, W. C. USA, Thomson Wadsworth. 2005.
5. Organizational Behaviour (3rd Ed) by Debra, L. N. & James Campbell Quick, Cincinnati: South Western.2000.

5. Professional Ethics

(3 0 3)

Objectives:

- To introduce students to contemporary ethical issues facing the business community.
- To enable students to demonstrate an understanding of their moral responsibilities and obligations as members of the workforce and society.

Course Contents:

Module 1 Overview of Business Ethics

- Business Ethics Defined, Social Responsibility, and Business Ethics, The Development of Business Ethics, Why study Business Ethics? Framework for Studying Business Ethics.

Module 2 Ethical issues in Business

- Foundation of Ethical Conflict, Classifications of Ethical, Issues, ethical Issues related to participants and Functional areas of business, Recognizing an ethical Issue.

Module 3 Applying Moral Philosophies to Business Ethics

- Moral Philosophy Defined, Moral Philosophy Perspectives.

Module 4 Social Responsibility

- The Economic Dimension, The legal Dimension, The Ethical Dimension, the Philanthropic Dimension.

Module 5 Ethical Decision-Making Framework

- Ethical Issue Intensity, Individual Factors: Stages of Cognitive Moral Development, Corporate Culture, Significant others, Opportunity, Business Ethics Evaluations and Intentions, Using the Ethical Decision-Making Framework to Improve Ethical Decisions.

Module 6 How the Organization Influences Ethical Decision Making

- Organizational Structure and Business Ethics, the role of Corporate Culture in Ethical Decision-Making, Group Dimensions of Organizational Structure and Culture, Implications of Organizational Relationships for Ethical Decisions.

Module 7 Role of Opportunity and Conflict

- Opportunity, Conflict.

Module 8 Development of an Effective Ethics Programme

- An Effective Ethical Compliance, Programme, Codes of Ethics and Compliance Standards, High-Level Manager's Responsibility for Ethical Compliance Programme and the Delegation of Authority, Effective Communication of Ethical Standards, Establishing Systems to Monitor, Audit, and Enforce Ethical Standards, Continuous Improvement of the Ethical Compliance Programme, The Influence of Personal Values in Business Ethics Programmes, The Ethical Compliance Audit.

Module 9 International Business Ethics

- Ethical Perceptions and International Business, Culture As a Factor in Business, Adapting Ethical Systems to a Global Framework: Cultural Relativism, the Multinational Corporation, A universal Set of Ethics, Ethical Issues Around the Globe.

Recommended Books:

1. Ethical Decision Making and Cases, by Ferrell, O. C., and J. Fredrich, New York: Houghton Mifflin.

6. Organizational Behaviour (3 0 3)

Objectives:

- To develop in students an understanding and appreciation of the field of organizational behavior to facilitate improvement in managerial and organizational effectiveness

Course Contents:

Module 1 Introduction to Organizational Behavior

- Organizational Disciplines and topics
- Psychological Perspective
- Social-Psychological Perspectives

Module 2 Structure and Control in Organization

- Introduction
- Bureaucracy
- Managerial Work
- Contingency theory
- Organizational Design

Module 3 Individual and Work Learning

- Learning Theories
- Learning and Work

Module 4 Stress

- Types of Stress and Work
- Occupational Stress Management

Module 5 Individual Differences

- Personality and its factors
- Personality dimensions and social learning
- Intelligence

Module 6 Motivation and Job Satisfaction

- Needs at Work
- Theories of Motivation and job satisfaction
- Correlates of Job satisfaction
- Correlates of Job satisfaction

Module 7 Group and Work

- Social Interaction
- Dramaturgy and impression Management
- Social Skill

Module 8 Group and Inter group Behavior

- Group Structure & Norms
- Group Processes
- How throne Studies

Module 9 Leadership

- Leadership as an attribute
- Leadership Style

Module 10 Patterns of Work

- Work-the classical approach
- Marx, Weber, & The critique of labor
- Foucault & Disciplinary Power

Module 11 Conflict and Consent in Work

- The labor Process debate
- Work place control and resistance
- Industrial conflict and industrial relations

Module 12 Organizational culture

- Organizational culture and strategic management
- Exploring organizational culture

- Evaluating concept of culture

Recommended Books:

1. Principles of Organizational Behaviour by Fincham, R., & Rhodes, P., Oxford. 2003.
2. Human Resource Management by Noe, R., Hollenbeck, J. Gerhart, B., & Wright, P. McGraw-Hill. 2005.
3. Organizational Behavior 12th Ed. by Newstrom John W. McGraw-Hill. 2007.
4. Organizational Behavior by Luthan Fred, McGraw Hill Inc. 2005.
5. Organizational Behavior by Robins, Stephen, McGraw-Hill Inc. 2005.

7. Introduction to Sociology

(3 0 3)

Objectives:

- To introduce students to different concepts and theories of sociology
- To develop an understanding of contemporary social issues and their impact on the society

Course Contents:

Module 1 Nature of Sociology

- The study of social life
- Exploring the global village
- Sociology as a science
- The Sociological imagination
- The development of Sociology
- Pioneers of Sociology
- Nature, scope and subject matter of Sociology
- Brief historical development of Sociology
- Society and community
- Relationship with other social sciences
- Social Interaction Processes

Module 2 Social groups

- Definition and functions
- Types of social groups

Module 3 Social institutions

- Definition
- Structure and function of social institutions
- Inter-relationships among various social institutions

Module 4 Culture and related concepts

- Definition and aspects of culture
- Elements of culture
- Organization of culture
- Other concepts, cultural relativism, sub cultures, ethnocentrism, culture lag

Module 5 Socialization and personality

- Role and status
- Socialization
- Culture and personality

Module 6 Deviance and social control

- Definition and types of deviance
- Juvenile delinquency
- Formal and information methods of social control

Module 7 Social stratification

- Approach to study social stratification
- Caste class and race as basics of social stratification

Module 8 Major perspectives in Sociology

- Functionalist perspective
- Conflict perspective
- Inter-actionstic perspective

Module 9 Social Control and deviance

- Agencies of social control

Module 10 Social stratification

- Determinants of social stratification
- Social mobility, types and definition
- Dynamics of social mobility

Module 11 Concept of social movement

- Theories of social movement
- Social and cultural change

Module 12 Social and cultural change

- Definition of social change
- Dynamics of social change
- Impact of globalization on society and culture
- Resistance to change

Module 13 Collective behaviour

- Definition
- Characteristics
- Causes
- Types
- Social movements
- Mob and crowd behaviour

Recommended Books:

1. Sociology: Diversity, Conflict and Change, by Neulreck, Kenneth, J. Boston. 2005.
2. Sociology by Barnard, Andy. Cambridge University Press. 2004
3. Sociology 4th edition by Giddens, Anthony, Cambridge Polity Press, 2004.
4. Sociology by Albrow, Martin, London Routledge.2003.

5. Sociology 5th edition by Richard, T. Schaefer, McGraw Hill College, 2003.

8. Critical Thinking

(3 0 3)

Objectives:

- To develop in students an understanding of the thinking process
- To develop in students critical/analytical thinking skills

Course Contents:

Module 1 Power of Critical Thinking

- Claims and Reasons
- Reasons and Arguments
- Arguments in the Rough

Module 2 Environment of Critical Thinking

- Perils of Haunted Mind
- Self and the Power of the Group
- Subjective and Social Relativism
- Skepticism

Module 3 Making Sense of Arguments

- Arguments Basics
- Patterns
- Diagramming Arguments
- Assessing Long Arguments

Module 4 Reasons for Belief and Doubt

- Conflict Experts and Evidence
- Personal Experience
- Fooling Ourselves
- Claims in the News

Module 5 Faulty Reasoning

- Irrelevant Premises
- Genetic Fallacy, Composition, Division
- Appeal to the Person, Equivocation, Appeal to Popularity
- Appeal to Tradition, Appeal to Ignorance, Appeal to Emotion
- Red Herring, Straw Man

Module 6 Unacceptable Premises

- Begging the Question, False Dilemma
- Slippery Slope, Hasty Generalization
- Faulty Analogy

Module 7 Deductive Reasoning: Propositional Logic

- Connectives and Truth Values
- Conjunction, Disjunction, Negation
- Conditional, Checking for Validity
- Simple Arguments, Tricky Arguments

- Streamlined Evaluation

Module 8 Deductive Reasoning: Categorical Logic

- Statements and Classes
- Translations and Standard Form
- Terms, Quantifiers
- Diagramming Categorical Statements
- Sizing up Categorical Syllogisms

Module 9 Inductive Reasons

- Enumerative Induction
- Sample Size, Representativeness, Opinion Polls
- Analogical Induction
- Casual Arguments, Testing for Causes
- Casual Confusions

Module 10 Inference to the Best Explanation

- Explanations and Inference
- Theories and Consistency
- Theories and Criteria
- Testability, Fruitfulness, Scope, Simplicity
- Conservatism

Module 11 Judging Scientific Theories

- Science and Not Science
- The Scientific method, Testing Scientific Theories
- Judging Scientific Theories
- Copernicus versus Ptolemy, Evolution Versus Creationism
- Science and Weird Theories
- Making Weird Mistakes
- Leaping to the Weirdest Theory, Mixing What Seems with What is
- Misunderstanding the Possibilities
- Judging Weird Theories
- Crop Circles, Talking with the Dead

Recommended Books:

1. The Power of Critical Thinking, by Vaughn Lewis, Oxford University Press. 2005.
2. Critical Reasoning by Paulsen David W. & Cederblom Jerry, Wadsworth, 2000.
3. Logic: An Introduction, by Restall Greg. Routledge 2005.

9. Introduction to Philosophy (3 0 3)

Objectives:

- To introduce students to different aspects of philosophy and the works of prominent philosophers
- To develop in students an understanding about the impact of philosophy on social, political and economic spheres

Course Contents:

Module 1 Definition and Nature of Philosophy

Module 2 Theory of Knowledge

- Opinion and Knowledge
- Plato, the Republic Selection
- Knowledge through Reason
- Descartes Meditation on First Philosophy
- Knowledge through Experience
- Hume an Inquiry concerning Human Understanding (Selection)
- Experience Structured by the Mind
- Kant Critique of Pure Reason (Selection)
- Knowing and Doing
- James Pragmatism (Selection)
- Knowledge and Emotion
- Jaggar Love and Knowledge (Selection)

Module 3 Philosophy of Religion

- Proving that Existence of God
- Anselm, Aquinas, Paley, Dawkins (Selection)
- Justifying Religious Beliefs
- Pascal Pensees (Selection)
- James The will to Believe Selection
- Freud the Future of An Illusion (Selection)
- Confronting the Problems of Evil
- Mackie Evil and Omnipotence (Complete)
- Hick Philosophy of Religion (Selection)

Module 4 Metaphysics

- Idealism and Materialism
- Berkeley Three Dialogues Between Hylas and Pholonous (Selection)
- Armstrong Naturalism, Materialism and First Philosophy (Selection)
- The Mid-Body Problem
- Descartes Meditations on First Philosophy (Selection)
- O'Hear Introduction to the Philosophy of Science (Selection)
- Dennett The Origins of Selves (Complete)
- Pali Canon (Selection)
- Penelhum Religion and Rationality (Selection)

Module 5 Freedom to Choose

- Libertarianism
- James The Dilemma of Determinism (Selection)
- Taylor Metaphysics (Selection)
- Determinism
- Hospers Meaning and Free Will (Selection)
- Skinner Walden Two (Selection)
- Compatibilism
- Stace Religion and the Modern Mind (Selection)
- Radhakrishnan Indian Philosophy (Selection)

Module 6 Ethics

- Fulfilling Human Nature
- Aristotle Nicomachean Ethics (selection)
- Loving God
- Augustine The Morals of the Catholic Church and the City of God (Selection)
- Following Natural Law
- Aquinas Summa Theologiae (Selection)
- Doing One's Duty
- Kant Fundamental Principles of the Metaphysics of Morals (Selection)
- Maximizing Utility
- Mill Utilitarianism (Selection)
- Turning Values of Upside Down
- Nietzsche Human, All too Human and Beyond Good and Evil (Selection)
- Creating Ourselves
- Sartre Existentialism is a Humanism (Selection)
- Hearing the Feminine Voice
- Gilligan In a Different Voice (Selection)
- Baier What do Women Want in a Moral Theory (Selection)

Module 7 Political and Social Philosophy

- The State as Natural
- Plato the Republic (Selection)
- Aristotle Politics (Selection)
- The State as a Social Contract
- Hobbes Philosophical Rudiments Concerning Government and Society (Selection)
- Locke the Second Treatise of Government (Selection)
- Liberty of the Individual
- Mill On Liberty (Selection)
- Alienation in Capitalism
- Marx Economic and Philosophic Manuscripts of 1844 (Selection)
- Justice and Social Trust
- Rawls A Theory of Justice (Selection)
- Nozick Anarchy, State, and Utopia (Selection)
- Held Rights and Goods (Selection)
- Women in Society
- Wollstonecraft A Vindication of the Rights of Women (Selection)
- De Behavior The Second Sex (Selection)
- The Value of Philosophy
- Russel The Problems of Philosophy (Selection)
- Midgley Philosophical Plumbing (Selection)

Recommended Books:

1. Elements of Philosophy: An Introduction, 4th Ed. by Abel Donald C. & Stumpf Samuel Enoch, McGraw-Hill. 2002.
2. A short History of Modern Philosophy, 2nd ed. by Scruton Roger, 2001. Routledge.

10. Human Resource Development (3 0 3)

Objectives:

- To develop in students skills for assessing and meeting the requirements of human resource development.

Course Contents:

Module 1 Introduction to HRD

- Progress toward a field of HRD. Relationship between HRM & HRD, HRD Functions. Critical HRD Issues, Organizational Structure of HRD Departments. Roles and Competencies of HRD professionals.

Module 2 HRD Requirements

- HRD Requirements in industry, Certification and Education for HRD professionals, Challenges to Organizations and HRD Professionals.

Module 3 HRD Framework

- A Framework for HRD Process, Example of Human Resource Development in an Organization. Influence on Employee Behaviour.

Module 4 HRD Techniques

- Performance Appraisal, Potential Appraisal, Career Planning, Career Development. Organizational Change, Organizational Development, Workers participation Management. Quality Circles, Team Work, Role Analysis, Employee Training, Executive Development.

Module 5 Need Assessment

- Assessing HRD Needs, Designing effective HRD program, Implementing HRD Program, Evaluating HRD Programs.

Module 6 Training & Development

- Human Resource training and development, Career Development, Employee Socialization and Orientation, Skills and Technical Training. Coaching and performance management, Employee Counseling and Wellness Services, Employee Counseling and Wellness Services, Learning and HRD Organizational development and change, HRD and Diversity.

Recommended Books:

1. Human Resource Development by Jon M. Werner and R. L. DeSimone
2. Strategic Human Resource Development by Lyle Yorks, 2005
3. Foundations of Human Resource Development by Richard A. Swanson and Elwood F. Holton III

COURSE CONTENTS – MANAGEMENT SCIENCES

1. Management Science–I
2. Management Science–II

Note: The following courses should be considered as guidelines. Universities may also offer any other two introductory management courses of their choice.

1. Entrepreneurship (3 0 3)

Objectives:

- Entrepreneurship is an important component in the process of economic development. The purpose of this course is to analyze the theories of entrepreneurship and to go for case studies of successful entrepreneurs.

Course Contents:

Module 1 Introduction

- The concept of entrepreneurship, the economist view of entrepreneurship, the sociologist view, Behavioral approach, Entrepreneurship and Management.

Module 2 Practice of Entrepreneurship

- The process of entrepreneurship, Entrepreneurial Management, The entrepreneurial business, Entrepreneurship in service institutions, the new venture.

Module 3 Entrepreneurship and Innovation

- The innovation concepts, Importance of innovation for entrepreneurship, Sources of innovative opportunities, the innovation process, Risks involved in innovation.

Module 4 Developing Entrepreneur

- Entrepreneurial profile, Trait approach to understanding entrepreneurship, Factors influencing entrepreneurship, the environment, Socio cultural factors, Support systems.

Module 5 Entrepreneurship Organization

- Team work, Networking organization, Motivation and compensation, Value system.

Module 6 Entrepreneurship and SMES

- Defining SMEs, Scope of SMEs, Entrepreneurial, managers of SME, Financial and marketing problems of SMEs.

Module 7 Entrepreneurial Marketing

- Framework for developing entrepreneurial marketing, Devising entrepreneurial marketing plan, Entrepreneurial marketing strategies, Product quality and design.

Module 8 Entrepreneurship and Economic Development

- Role of entrepreneur in the economic development generation of services, Employment creation and training, Ideas, knowledge and skill development, The Japanese experience.

Module 9 Case Studies of Successful Entrepreneurs

Recommended Books:

1. Small Business and Entrepreneurship by Paul Burns and Jim Dew Hurst:
2. Entrepreneurship for Economic Growth by P.N. Singh:
3. Innovation and Entrepreneurship by Peter F. Drucker
4. Entrepreneurial Success by John B. Miner

2. Principles of Management (3 0 3)

Objectives:

- The focus of attention will be given to learning fundamental principles of management and of managing people and organization in a historical as well as contemporary world. Students are expected to develop analytical and conceptual framework of how people are managed in small, medium and large public and private national and international organizations.

Course Contents:

Module 1 Management and Managers

- Introduction, overview and scope of discipline

Module 2 Evolution and Emergence of Management Thought

Module 3 Management Functions

Module 4 Foundation of Planning

- Planning concepts, objectives, strategies and policies

Module 5 Decision Making & Organization Design

- Organizing; departmentalization, line/staff authority, commitments and group decision making

Module 6 Staffing

- Principles of selection, performance and career planning

Module 7 Leading

- Motivation, leadership and communication

Module 8 Controlling

- System and process and techniques of controlling

Module 9 Management and Society

- Future perspective

Recommended Books:

1. Management by Stephen P. Robins, Mary Coulter
2. Management by H. Koontz O. donnel and H. Weihrich
3. McFarland: Management by Foundation and Practice
4. The New Management by Robert M. Fulmer

3. Quality Management Systems (3 0 3)

Objectives:

- To get understanding of the quality management systems in each activity of an operation unit

Course Contents:

Module 1 Quality Concept

- What is Quality, What is Quality Management System, TQM concepts, System thinking.

Module 2 Quality Gurus

Module 3 Quality Parameters and Standards

- How to do Quality work, Quality Parameters, Quality Management Standards&ISO-9000, SOPs

Module 4 How to do Quality Work

- The perfection standards, Statistical Process Control, Management of Process Quality, How to trace root causes of the Quality Problems, Attention to causes, Quality Planning, Action oriented Quality Plan, Quality Policy, Technology and Quality, Unwavering Commitments, Leadership Qualities, Prevention and Quality, Quality Information System, Timely Training, Impact of Training on Quality, Quality Consciousness, Quality as a challenge, Continuous improvement in each activity, Reward Quality performance, Attractive communications, Degree of Competency, Raw material and Quality, Customer Focus and Customer Perception of Quality, Beldridge, Quality Award, Quality Audit, Product identification & traceability.

Module 5 Benchmarking and Six Sigma

Recommended Books:

1. Total Quality Control by Armand V. Feigenbaum
2. Total Quality Management by P. N. Mukherjee
3. Total quality management: text with cases by John S. Oakland
4. Quality Planning and Analysis by J. M. Juran and Frank Gryna
5. Managerial Breakthrough by J. M. Juran
6. Total Quality Control by A. V. Fiegenbaum
7. The Six Sigma Way by Peter Pande and others
8. Quality is Free by Phil Crosby

4. Engineering Management

(3 0 3)

Objectives:

- To understand the engineering management in textile operation unit to improve the management system.

Course Contents:

Module 1 Introduction

- What is engineering? What is Management? What is Engineering Management? Management functions, Textile Engineering Management.

Module 2 Project management

- What is a Project? Textile Mill project management, Project management phases (Planning, Construction of Building, Installment of Machines, and Running of Machines).

Module 3 Process Management

- Process Management Definition, Generic process elements (Inputs, Transformation, and Outputs), Process Management in Spinning, Weaving, Textile Processing, and Garment Manufacturing

Module 4 Maintenance Management

- Maintenance Objectives, Responsibilities of Maintenance Department, Benefits of Maintenance, Principles of Maintenance, Types of Maintenance Systems, Maintenance Policies, Scope of Preventive Maintenance, Cost of Maintenance, Effectiveness of Preventive Maintenance, Benefits of Planned Preventive Maintenance, Development of Checklist (Main Indicators like Abnormal Sound, Vibrations etc), Planning of Maintenance Function, Training Programs in Maintenance, Motivation in Maintenance, Benefits of Computerized Maintenance System, Estimation of Maintenance Cost, Organizational requirements for Maintenance, Advantages of centralized facilities for Maintenance, Role of proper lubrication in Maintenance Management, Types of Lubricants, Selection of Lubricant, Store Management, Spare parts control, Decision making in Maintenance, Environmental impact on Maintenance, Manpower Planning for Maintenance, Energy Conservation & Maintenance (Short Term and long term Measures).

Module 5 Human Resource Management

- Human Resource Management Definition, Human Resource Management Role in textile Organizations, Recruitment, Selection, Performance Management, Employee Relations, Labor Relations.

Module 6 Inventory Management

- Inventory Management Definition, inventory functions, inventory types, Inventory Management Systems, effective and efficient inventory management, Inventory Management in textile industry.

Module 7 Material Management

- Effective Materials Management techniques, Setting comprehensive inventory goals & objectives, Materials Management Challenges, Benefits.

Recommended Books:

1. Engineering Management: Challenges in the New Millennium by C. M. Chang, 2004
2. Engineering Management: Creating and Managing World Class Operation by W. Dale Compton, 1997
3. Engineering Management by Fraidoon Mezda, 1997
4. Essentials of Manufacturing Engineering Management by Peter Pang, 2004
5. Engineering Project Management by N. J. Smith, 2002
6. Basic Cost Engineering by Kenneth K. Humphreys, 1995
7. Cost Analysis and Estimating for Engineering and Management by Phillip F. Ostwald, 2003
8. Hand Book of Industrial Engineering: Technology and Operations Management by Gavriel Salvendy, 2001

5. Textile Marketing

(3 0 3)

Objectives:

- To know the customer expectations and needs for national and international marketing requirements.

Course Contents:

Module 1 Textile Marketing

- Importance, evolution, types and terminologies

Module 2 Customer Importance

- Building customer satisfaction through quality, service and value.
- The customer and product consumption

Module 3 Marketing Management

- Analyzing marketing environment
- Strategic marketing planning
- Marketing research and product information
- Marketing objectives
- Introduction to marketing mix (4Ps).

Module 4 Economic Development

- Marketing in controlled or slow economic growth

Module 5 Market segmentation

- Targeting and positioning

Module 6 Pricing & Promotion

- Pricing

- Promotion – above the line 4 Ps
- Promotion – below the line 4 Ps

Module 7 Textile trade & International marketing

- Apply the key terms, definitions and concepts used in marketing with an international perspective
- Understand major macro-environmental factors in global markets
- Use market research skills on a global scale for strategic positioning and foreign market penetration
- Develop creative international market entry strategy
- Understand the importance of Internet for global business
- Apply basic and advanced marketing concepts to develop integrated marketing plans in global markets

Recommended Books:

1. Principles of Marketing, 13 Editions, by Kotler/Armstrong, Prentice-Hall 2010.
2. Marketing Aesthetics: the strategic management of brands, identity, and image by Bernd Schmitt, Alex Simonson
3. Marketing Management: By M. C. Cant, J. W. Strydom, C. J. Jooste.

6. Industrial Engineering and Management (3 0 3)

Objectives:

After completing this course students should be able to:

- Manage purchases and stores.
- Understand financial management
- Get acquainted with work and work study

Course Contents:

Module 1 Introduction

- History and development, Modern definition and function of Industrial Engineering.

Module 2 Material, Purchase and Store Management

- Introduction to material management, Functions and objectives of Materials management, Purchasing or procurement, Introduction, objectives of purchasing dept. Activities/duties of purchasing department, Purchasing. Organization buying Techniques, Store Management, Functions of Store dept, and duties of the store keeper, Location and layout of stores, Receipt, & issue of material, store record, store ledger.

Module 3 Financial Management

- Concept and definition, Types of capital, sources of finance, Reserves, Surplus, financial Accounting and Book Keeping, System of Book keeping (Single Entry and Double Entry System).

Module 4 Assets and liabilities

- The journal & ledger, Trial balance, financial statement, profit & loss account, Balance sheet.

Module 5 Cost Accounting and Control

- Introduction, Elements of control, types of control, Depreciation, causes of Depreciation, Methods of calculating Depreciation, Breaks even Analysis, concept, Importance and scope, calculation of Break-even point, Break even chart.

Module 6 Work Study

- Method study, Procedure of conducting, method of study, work measurement, synthesis and analytical estimating, PMTS (MTM1, MTM2, MTM3) and ready work factor (RWF), system Manual time study, Rating Technique.

Module 7 Network Analysis

- Introduction, Techniques, Terms related to Network planning Method, PERT, CPM, and Application of network techniques to simple Engineering Problems.

Recommended Books:

1. Industrial Engineering by R. B. Gupta
2. Production Planning/Control & Industrial Engg. Management by K. C. Jain & L. N. Aggrawal
3. Industrial Organization & Engineering Economics by T. R. Range & S. C. Sharma
4. Industrial Engineering by Richard C. Vaughan.

COURSE CONTENTS – NATURAL SCIENCES

1. Calculus–I
2. Calculus–II
3. Calculus–III
4. Physics–I
5. Chemistry–I
6. Physics–II
7. Chemistry–II

1. **Calculus–I** (3 0 3)

Objectives:

- The objective of this course is to familiarize the textile engineering students with the fundamental concepts of calculus including derivatives and integration along with their applications.

Note: This course should be taught with the aid of computing softwares such as mathematica, MATLAB ...etc.

Course Contents:

Module 1 Engineering Functions

- Real numbers and real line, Engineering functions, Shifting graphs, Trigonometric functions.

Module 2 Derivatives and their Application

- Derivatives of a function, Differentiation rules, Rates of change, Derivatives of trigonometric functions, Chain rule, Extrema on an interval, Rolle's and mean value theorem, Increasing and decreasing functions and first derivative test, Concavity and second derivative test, Optimization problems, Differentials, Limits at Infinity, Summary of curve sketching.

Module 3 Integration and its Application

- Indefinite integrals, Integration by substitution, Riemann sums and definite integrals, Fundamental theorem, Area of a region between two curves, Volume by the slicing, disk, washer and shell method, Arc length and surface of revolution.

Module 4 Transcendental Functions:

- Indeterminate forms, inverse trigonometric functions and their derivatives, Integrals, Hyperbolic functions.

Module 5 Techniques of Integration:

- Basic integration formulas integration by parts, Trigonometric substitutions, Improper integrals.

Module 6 Multivariable Functions and Partial Derivatives:

- Functions of several variables, Partial derivatives, Higher order partial derivatives, Differentials, Chain rule.

Module 7 Infinite Series

- Sequences, Limit of an infinite sequence, Convergent and divergent sequences, Bounded sequences, Monotone sequences, Infinite series, Convergence, Tests for convergence, Absolute and conditional convergence.

Recommended Books:

1. Calculus and Analytic Geometry by George B. Thomas and Ross L. Finney, 2002
2. Advanced Engineering Mathematics by Ervin Kreyszig, 2007

2. Calculus–II

(3 0 3)

Objectives:

The objective of this course is to familiarize the textile engineering students with the fundamental concepts differential equations, Laplace transform and their applications in textile engineering.

Note: This course should be taught with the aid of computing softwares such as mathematica, MATLAB ...etc.

Course Contents:

Module 1 First Order Differential Equations

- Basic concepts and ideas, Differential equations and their classifications, Formation of differential equations, Initial and boundary conditions, Geometrical meaning of $\dot{y}=f(x,y)$, Separable differential equations, Homogenous equations, Differential equations reducible to homogenous form, Exact equations, Integrating factors, Linear equations, The Bernoulli equation, Orthogonal trajectories of curves, Clairaut's equation.

Module 2 Linear Differential Equations of Second and Higher Order

- Homogenous linear Equations of second order, Differential operators, Euler-Cauchy equation, Homogenous linear equations, Reduction of order, Existence and uniqueness theory, Wronskian variation of parameters, Higher order differential equations, Higher order homogenous equations with constant coefficients, Higher order non-homogenous equations.

Module 3 Series Solution of Differential Equations, Special Functions

- Power series method, Theory of power series method, Legendre's equation, Legendre polynomials, Frobenius method.

Module 4 System of Differential Equations

- Vectors, matrices, Eigenvalues, Homogenous systems with constant coefficients, Phase plane, Critical points, Criteria for critical points, Stability, Non-homogenous linear systems.

Module 5 Laplace Transforms

- Properties of laplace transforms, Tables of some laplace transforms, Inverse transforms, Linearity, Shifting, Transforms of derivatives and integral, Differential equation, Solution of initial value problems.

Recommended Books:

1. Calculus and Analytic Geometry by George B. Thomas and Ross L. Finney, 2002
2. Advanced Engineering Mathematics by Ervin Kreyszig, 2007

3. Calculus–III

(3 0 3)

Objectives:

The objective of this course is to familiarize the textile engineering students with the fundamental concepts of linear algebra, matrices & vectors, linear system of equations, Fourier analysis and complex numbers, and their applications in textile engineering.

Note: This course should be taught with the aid of computing software such as mathematica, MATLAB ...etc.

Course Contents:

Module 1 Linear Algebra-Matrices, Vectors

- Basic concepts, Matrix addition, Scalar multiplication, Linear system of equations gauss elimination, Partitioning of matrices, Elementary row operations, Elementary column operations rank of matrix, Linear independence, Solution of linear systems.

Module 2 Determinations, Linear System of Equations

- Determinations, Cramer's rule, Inverse of a matrix, Gauss-Jordan elimination, Vector spaces, Linear product spaces, Linear transformations.

Module 3 Matrix Eigenvalue Problems

- Eigenvalues, Eigenvectors some application of eigenvalues problems, Symmetric, Skew-symmetric and orthogonal matrices, Complex matrices: Hermitian, Skew-Hermitian, Unitary, Similarity of matrices, Basis of eigenvectors, Diagonalization.

Module 4 Fourier Analysis

- Periodic functions, Trigonometric series, Fourier series Functions of any period $p = 2L$, Even and odd functions, Half – Range expansions, Complex Fourier series, Fourier integral, Fourier cosines and sine transforms, Fourier transforms, Table of transforms.

Module 5 Complex Numbers

- Complex numbers, Complex plane, Polar form of complex numbers, De-Moiver's theorem, the n th root of complex numbers, Application of De-Moiver's theorem in summation of series.

Recommended Books:

1. Calculus and Analytic Geometry by George B. Thomas and Ross L. Finney, 2002
2. Advanced Engineering Mathematics by Ervin Kreyszig, 2007

4. Physics-I

(3 1 4)

Objectives:

The objective of this course is to familiarize the textile engineering students with the fundamental concepts of statics of continuous media, dynamics of fluids, temperature and heat flow and mechanics, and their applications in textile engineering.

Course Contents:

Module 1 Statics

- Stress and strain, types of stress and strain, modulus and its types, Poisson's ratio.

Module 2 Force and Motion

- Force, Laws of motion, Linear and circular motion. Torque, Friction and its types.

Module 3 Dynamics of Fluids

- Steady state and the continuity equation, Bernoulli's equation, Laminar and turbulent flow. Capillary action, Viscous fluid flow.

Module 4 Work and Energy

- Power and Momentum, Linear momentum and mechanical energy, Potential energy, Kinetic energy, Rotational mechanics.

Module 5 Thermodynamics

- The first law of thermodynamics, the second law of thermodynamics; conduction, convection and radiation; Phase changes; latent heat, specific heat, sensible heat, calorimetry.

Module 6 Waves and sound

- Nature of waves, Periodic waves and vibrations, sound intensity and its measurement, Doppler effect.

Lab Outline:

As per Course Contents

Recommended Books:

1. University Physics by Young and Freedman
2. Physics by Halliday, Resnick and Krane
3. Physics for Scientist and Engineers by Lawrence S. Lerner, 1996

5. Physics-II

(2 1 3)

Objectives:

The objective of this course is to familiarize the textile engineering students with the fundamental concepts of electric force and electric field, electric flux, electric potential, capacitance and optics.

Course Contents:

Module 1 Electricity and Magnetism

- Electric, magnetic and electromagnetic fields, Coulomb's law, Insulators and conductors, electrical energy, capacitors and capacitance, dielectric constant, current, resistance, Ampere's Law, Ohms law, alternating current and direct current, Magnetism and its types, Torque on a current loop and electric motors.

Module 2 Optics

- Nature of light, interaction of light with matter (reflection, refraction, absorption, scattering, transmission, dispersion, polarization, interference and their laws/theories), refractive index, Diffraction grating, Geometric optics.

Module 3 Optical instruments

- Compound microscope, stereo microscope, refractometer, spectrophotometer.

Lab Outline:

As per Course Contents

Recommended Books:

1. University Physics by Young and Freedman
2. Physics by Halliday, Resnick and Krane
3. Physics for Scientist and Engineers by Lawrence S. Lerner, 1996
4. Basic optics and optical instruments by F. A. Carson, 2011.

6. Chemistry-I (3 1 4)

Objectives:

Course Contents:

Module 1 Water

- Introduction to water, Sources of water, Distribution of water on earth, Use of water in Textile industry, Properties of water, Impurities present in water (Suspended Impurities, Soluble Impurities), Effect of impurities in Textile Wet Processing, Hard water and Soft water, Causes of Hardness, Types of hardness, Methods for the Removal of Hardness of water, Essential requirements for drinking and Textile Wet Processing water.

Module 2 Solutions and their properties

- Types of solutions (molecular and colloidal), Concentration of solutions (weight/weight, volume/volume, weight/volume, degree Baume, degree Twadle, specific gravity, molarity, molality, normality).

Module 3 Chemical and physical bonding

- Types of bonding (ionic, covalent, coordinate covalent, hydrogen, van der Waal's forces), Conditions for bond formation and their energies.

Module 4 Chemical reactions

- Acid-Base exchange reactions, oxidation and reduction reactions. Addition and substitution reactions. Chemical Kinetics, Chemical equilibrium, Chemical and biological catalyst.

Module 5 Acids, Basis and Electrolytes

- Theories on acids and bases, pH and measurement of pH, Buffer solutions, Acid, bases, and electrolytes used in textile industry (Acetic, oxalic, formic, sulphuric and hydrochloric acids, sodium bicarbonate, sodium carbonate, sodium hydroxide, liquor ammonia, common salt, Glauber's salt, metallic salts and organic salts)

Lab Outline:

As per Course Contents

Recommended Books:

1. General Chemistry by John W. Hill, 2004
2. Physical Chemistry by F. Hussain
3. Physical Chemistry by G. Nabi

7. Chemistry-II

(3 1 4)

Objectives:

Course Contents:

Module 1 Chemistry and Properties of Surfactants

- Hydrophiles, Hydrophobes, Types of Surfactants (anionic, cationic, non-ionic, amphoteric), properties of surfactants and their solutions (surface tension, hydrophilic-lipophilic balance, cloud point, critical micelle concentration).

Module 2 Chemical auxiliaries used in textile processing

- Enzymes, Wetting agents and detergents, Sequestering/Complexing/Chelating agents, Dispersing and solubilising agents, leveling and retarding agents, thickening agents, dye exhausting and fixing agents, migration inhibitors, anti-foaming agents.

Module 3 Soaps and Emulsions

- Oils, fats, waxes, saponification, emulsifiers, emulsification, macro-, micro- and nano-emulsions, oil/water and water/oil emulsions.

Module 4 Applied Organic Chemistry

- Hydrocarbons and their application in textiles, Functional groups and their properties (Alcohols, carboxylic acids, esters, amines and amides), Carbohydrates (polysaccharides, starch, cellulose, chitosan)

Lab Outline:

As per Course Contents

Recommended Books:

1. Organic Chemistry by L.G. Wade, 2006
2. Organic Chemistry by Paul Y. Bruice, 2006

COURSE CONTENTS – COMPUTING

1. Introduction to Computers
2. Computer Programming
3. Computer Application in Engineering Design

1. Introduction to Computers (2 1 3)

Objectives:

The objective of this course is to introduce students to different components of computers and their working principles. The students will also become proficient in use of MS Word, MS Excel and MS Powerpoint.

Course Contents:

Module 1 Computer Fundamentals

- Components of a computer
- Input & output devices
- Storage and communications devices
- System unit and motherboard
- Processor
- Expansion slots and adapter cards
- Ports and connectors
- Buses and bays
- Technical specifications of a computer

Module 2 Operating systems and Utility Programmes

- System software
- Operating systems
- Functions of an operating system
- Stand-alone operating systems
- Server operating systems
- Embedded operating systems
- Utility programmes

Module 3 Internet and the Worldwide Web

- Evolution of the internet
- Intranet vs. internet
- Introduction to E-commerce and other internet services

Module 4 Communications and Networks

- Different means of communications through computers
- Networks (LAN, WAN, etc.)
- Networks communications standards and settings
- Communication devices (dial-up, digital, wireless modems)

Module 5 Computer Security, Ethics and Privacy

- Internet and network attacks, and security
- Unauthorized access and use (hacking)

- Hardware, software and information theft
- System failure and back-up

Module 6 Working with Microsoft Word

- Viewing and editing text in MS Word
- Formatting text in MS WORD
- Inserting and formatting table, pictures, clip art, shapes, smart art, charts, hyperlinks, book marks, header, footer, equations and symbols in MS Word
- Different page layouts
- Inserting and formatting academic references, footnotes, end notes, bibliography and table of contents in MS Word
- Reviewing and printing MS Word documents (spelling and grammar, word count, adding comments, tracking, accepting and rejecting changes)

Module 7 Working with MS Excel

- Entering/editing data
- Formatting cells and numbers
- Formatting, sorting and filtering data
- Inserting and formatting different types of graphs and charts (column, bar, line, pie, area and scatter charts)
- Inserting formulae and doing additions, subtractions, divisions, multiplications, and other calculations
- Using different mathematical, statistical, trigonometric, logical and engineering functions
- Data presentation and analysis using MS Excel
- Protecting and sharing worksheets

Module 8 Working with MS Powerpoint

- Selecting and formatting slide layout
- Inserting and formatting slides
- Inserting tables, images, illustration, symbols and media in slides
- Formatting slide designs and styles
- Adding transitions and animations
- Setting-up and running slide shows
- Making effective powerpoint presentations

Lab Outline:

As per curriculum

Note: The theory of the subject should be integrated with practical exercises in the Lab. The emphasis should be on hands-on exercises rather than on excessive theoretical lectures.

Recommended Books:

1. Discovering Computers 2011 by Gary B. Shelly and Misty E. Vermaat (2010).
2. Microsoft Office 2010 Plain & Simple by Katherine Murray (2010).
3. Discovering Computers by Shelly, Casbman, Waggoner, 2010

4. Introduction to Computers by Peter Norton 2004
5. Absolute beginner's Guide to Computer Basics by Michael Miller, 2007
6. How Computer Work by Rou White and Timothy Edward Donns, 2005

2. Computer Programming (2 1 3)

Note: The Universities may offer either C++ or Visual Basic for Applications (VBA) in Microsoft Excel

Course Contents:

C++

- Introduction to programming in C++ with emphasis on algorithm development and problem solving. Methodical development of C++ programs from specifications, Documentation and styles, Appropriate use of controlled structure, Data types and sub programs, Data abstraction and verification, Numeric and non-numeric applications, Introduction to object-oriented programming and design.

VBA for Excel

Module 1 Introduction

- The idea of a program
- Decisions and loops

Module 2 Overview of VBA for Excel

- The Excel/VBA Environment
- An Excel Interface and a VBA Macro Programme

Module 3 Recording Macros

- Macro Recording
- Hands-on Exercise: Macro Recording to Format a Range of Cells
- Absolute and Relative References
- Using Macro Recording to Learn about VBA

Module 4 Customized Worksheet Functions

- The "Idea" of a Function
- Worksheet Function Macros
- Hands-on Exercise: A Simple Worksheet Function Macro

Module 5 Modular Programming

- Sub Procedures
- Hands-on Exercise: The Kick Calculator
- Function Procedures
- More about Procedure Arguments
- Hands-on Exercise: The Behaviour of the Parameter List
- Passing by Value or by Reference
- Hands-on Exercise: Passing by Value or by Reference
- Static Variables

Module 6 Object-oriented Programming

- Objects, Properties, Methods, and Collections
- Hands-on Exercise: OOP and a Recorded Macro
- Using Oop for Input/Output
- Learning More About Oop

Module 7 Debugging and Testing

- Debugging
- The VBA Help Facility
- Help Menu
- Context-Sensitive Help and the F1 Key
- Accessing Help from Error Messages
- Built-in Debugging Capabilities
- Passive Debugging: VBA Error Messages
- Active Debugging
- Hands-on Exercise: The VBA Debugger
- Testing

Module 8 Data Typing And Variable Scope

- Data Types
- Numeric Information
- Character, or “String,” Information
- Logical, or “Boolean,” Information
- Type Declaration
- Variant Data Type
- The Dim Statement
- Option Explicit
- Hands-on Exercise: Run Time for Single and Double Precision
- Type Declaration Characters
- The Const Statement
- Variable Scope and Lifetime
- The Parameter List
- Scope and Declaration

Module 9 Computations

- Computations
- Operator Priority
- Left to Right
- Built-in Numeric Functions
- Accessing Excel Functions from VBA

Module 10 Strings and Dialog Boxes

- String Functions and Manipulations
- Concatenating and Parsing Strings
- LCase and UCase
- Message Boxes
- Buttons
- Input Boxes
- Hands-on Exercise: Data Typing, String Functions, and Input Boxes

Module 11 Structured Programming: Decisions

- Structured Programming
- Flowcharts
- The If/Then/Else Decision Structure
- Indentation
- Single Decision Structure (If/Then)
- Single-Line If Statement
- If/Then/Elseif Structure
- Select Case Structure
- If/Then/Elseif Versus Select Case
- Nesting
- Compound Logical Expressions
- Logical Complements and DeMorgan's Theorem

Module 12 Structured Programming: Loops

- Decision Loops (Do/if Exit)
- Count-controlled Loops
- Nesting of Loops and Decisions
- Recursion
- Hands-on Exercise: Nonrecursive and Recursive Factorial Functions

Module 13 Data Structures: Arrays and Records

- Arrays
- Hands-on Exercise: Loops and Arrays
- Multidimensional Arrays
- Changing an Array's Lower Bound
- Passing Arrays to Procedures
- Hands-on Exercise: The Bubble Sort
- Dynamic Arrays and the ReDim Statement
- Records

Module 14 Creating and Accessing Files

- Sequential Files
- Hands-on Exercise: File Manipulations
- Other File Operations
- GetOpenFilename Method
- GetSaveAsFilename Method

Module 15 Custom Dialogue Boxes

- A Simple Custom Dialogue Box
- Hands-on Exercise: Developing a Simple Custom Dialogue Box
- Custom Dialogue Boxes and Modules
- Hands-on Exercise: Custom Dialogue Box and Modules

Lab Outline:

Exercises and activities pertaining to textile industry should be practiced.

Note: The theory of the subject should be integrated with practical exercises in the Lab. The emphasis should be on hands-on exercises rather than on excessive theoretical lectures.

Recommended Books:

1. C++ primer Plus by Stephen Prata, 2004
2. Sams Teach yourself C++ in 21 days by Jesse Liberty, 2004
3. C++ Programming for the Absolute Beginners by Dirk Henkemans and Mark Lee, 2002
4. Introduction to VBA for Excel, 2nd edition by Steven C. Chapra 2009
5. Excel 2010 Power Programming with VBA by John Walkenbach, Wiley 2010

3. Computer Application in Engineering Design (1 2 3)

Objectives:

The objective of this course is to impart in students the ability to apply different computer-based tools in the designing, modeling and simulation of textile and apparel products or textile machinery and instruments. The course should cover both the aesthetic as well as technical/functional aspects of the design. The theoretical should cover the fundamental principles of various aspects of design modeling and simulation while the lab part should include the hands-on exercises on appropriate computer-based tools such as CAD, MINITAB, MATLAB, etc.

Course Outline:

Module 1 Principles of Textile Product Design (For All Textile Engineers)

- Aesthetic and technical/functional aspects of textile product design
- Textile product design and development cycle
- Design conceptualization
- Design analysis

Module 2 Introduction to Computer Aided Design, Modeling and Simulation (For all Textile Engineers)

- Principles of computer aided design for textiles
- Introduction to different modeling and simulation techniques

Module 3 Yarn Design, Modeling and Simulation (For Textile Engineers Specializing in Yarn Manufacturing)

- Criteria and steps for materials selection for yarns
- Influence of fiber characteristics on performance and aesthetic properties of the yarn
- Influence of yarn characteristics on performance and comfort properties of the fabric
- Modeling and predicting yarn properties using statistical and soft computing techniques (ANN, ANFIS)
- Modeling and simulation of yarn manufacturing processes

Module 3 Fabric Design, Modeling and Simulation (For Textile Engineers Specializing in Fabric Manufacturing)

- Criteria and steps for materials selection for textile product design
- Influence of fibre characteristics on performance and aesthetic properties of the yarn
- Influence of yarn characteristics on performance and comfort properties of the fabric
- Influence of fabric structure and design on performance and comfort properties of the fabric
- Modeling and predicting fabric properties using statistical and soft computing techniques (ANN, ANFIS)
- Fabric design using CAD
- Modeling and simulation of fabric manufacturing processes

Module 3 Fabric and Processing Design, Modeling and Simulation (For Textile Engineers Specializing in Textile Processing)

- Criteria and steps for materials selection for textile product design
- Influence of fiber characteristics on performance and aesthetic properties of the yarn
- Influence of yarn characteristics on performance and comfort properties of the fabric
- Influence of fabric structure and design on performance and comfort properties of the fabric
- Influence of different chemical and mechanical finishes on performance and comfort properties of the fabric
- Modeling and predicting properties of dyed and finished fabrics using statistical and soft computing techniques (ANN, ANFIS)
- Modeling and simulation of textile pretreatment, coloration and finishing processes

Module 3 Apparel Design, Modeling and Simulation (For Textile Engineers Specializing in Garment Manufacturing)

- Influence of fiber characteristics on performance and aesthetic properties of the fabric
- Influence of yarn characteristics on performance and comfort properties of the fabric
- Influence of fabric structure and design on performance and comfort properties of the fabric
- Influence of different chemical and mechanical finishes on performance and comfort properties of the fabric
- Influence of apparel design and fit on its comfort and aesthetics
- Modeling, simulation and predicting garment properties using statistical and soft computing techniques (ANN, ANFIS)
- Apparel design using CAD

Lab Outline:

Linear, non-linear, stepwise and response surface regression modeling using MINITAB; Artificial neural network modeling using MATLAB.

Recommended Books:

1. Engineering Textiles: Integrating the Design and Manufacture of Textile Products by Y. E. Mogahzy, 2008.
2. Computer Technology for Textile and Apparel by J. Hu, 2011
3. Modeling and Predicting Textile Behavior by X. Chen, 2009
4. Soft computing in Textile Engineering by A. Majumdar, 2010

COURSE CONTENTS – ENGINEERING FOUNDATION

1. Introduction to Textile Engineering
2. Textile Raw Materials
3. Fibre Science
4. Mechanics of Fibrous Structures
5. High Performance Fibres
6. Environmental Issues of Textile Industry
7. Textile Engineering Utilities & Services
8. Statistical Methods in Textile Engineering

1. Introduction to Textile Engineering (2 0 2)

Objectives:

To get familiar with the history of textiles in general and textile history and market of Pakistan in particular. To get acquainted with different textile sectors.

Course Contents:

Module 1 Introduction

- Introduction to Textile engineering processes and textile machines. Introduction to various departments of a textile industry, description of general terms used in textiles.

Module 2 History of Textiles

- History and scope of textile sector around the globe; Textile material production and manufacturing; Textile sector of Pakistan.

Module 3 Textile Raw Material

- Introduction to textile fibres. General classification of textile fibres (Natural/Manmade) and their application.

Module 4 Cotton Ginning

- Process flow chart; Types of ginning. Preparation of cotton bales; Terms used in Ginning. Factors that can affect the fibre quality.

Module 5 Yarn Manufacturing

- Process flow chart; Introduction to yarn manufacturing machines.

Module 6 Fabric Manufacturing

- Process flow chart; Introduction to fabric manufacturing machines.

Module 7 Wet Processing

- Process flow chart; Introduction to Wet Processing (Pre-treatment, Dyeing, Printing, Finishing).

Module 8 Garment manufacturing

- Process flow chart; Introduction, pattern making, cutting, sewing.

Module 9 Textile and Fashion Design

Module 10 Technical Textiles

Recommended Books:

1. Introduction to Textile Technology by T. Ishida, 1991.
2. Textile Science by E. P. G. Gohl and L. D. Vilensky, 1987.
3. Textiles: Fiber to Fabric by Corbman B. P., 1985.
4. J. J. Pizzuto's Fabric Science by Allen C Cohen, Ingrid Johnson., 2010.
5. Textiles: Properties and Behavior in Clothing Use by Miller E. B T, 1984.

2. Textile Raw Materials

(4 0 4)

Objectives:

In this course, the students will study the classification of different textile fibres, their physical and chemical properties and end uses.

Course Contents:

Module 1 Textile Fibres

- Definition and classifications of textile fibers

Module 2 Vegetable Fibres

- Cotton: introduction of cotton and its types, Cultivation, harvesting and picking of cotton, Structure of cotton fibre, Physical, chemical properties and end uses of cotton fibre, Varieties of Pakistani cotton, Cotton grading.
- Bast fibres: Fibres such as jute, flax, ramie etc., Production and processing of bast fibres, Fiber properties and uses.
- Leaf fibres: Fibre such as abaca and sisal etc., Production, processing, properties and uses of leaf fibres.

Module 3 Animal Fibres

- Hair fibers: Introduction, classification, structure, production, properties and uses of wool fibers, Grading of wool, Introduction of fibers such as Camel, Mohair, Cashmere, Alpaca and Angora.
- Silk: Production, properties and uses of silk yarn.

Module 4 Mineral Fibres

- Introduction, processing, properties and end uses of natural mineral fibres such as Asbestos.

Module 5: Regenerated Fibres

- Manufacturing methods of viscose, cupramonium, lyocel, bamboo and acetate, fibres, Their properties and uses in textile industry.

Module 6 Synthetic Fibres

- Manufacturing methods of polyester, polyamide and acrylic fibres, their properties and uses in textile industry.
- Manufacturing methods of various elastane fibres, their properties and uses in textile industry.

Recommended Books:

1. Handbook of Textile Fibres (vol. 1 and 2) by J. Gordon Cook, 1984.
2. Cotton Science and Technology by S. Gordon and You-Lohsieh, 2007.
3. Regenerated cellulosic fibres by C. Woodings, 2001
4. Synthetic Fibers: Nylon, Polyester, Acrylic, Polyolefin by McIntyre, 2001

3. Fibre Science

(2 1 3)

Objectives:

In this course, the students will study in detail the microscopic and sub-microscopic structure, mechanical, chemical, electrical, thermal and optical properties of textile fibres.

Course Contents:

Module 1: Structure of Fibres

- Crystalline and non-crystalline materials, structure of crystals, polymer crystals, X-ray diffraction and crystallinity, assessment of crystallinity, microstructure and macrostructure of natural fibres; cotton and other vegetable fibres, silk wool and other animal fibres, micro and macro structure of synthetic fibres; polymer crystallization from the melt solution, fibre formation, microstructure of manmade fibres.

Module 2: Fiber Cross-section and Linear Density

- Fiber linear density, fiber cross-sectional shape and surface area, variability in fibre denier, measurement of denier, maturity of cotton; measurement of maturity using optical microscopy, differential dyeing as a test of maturity, measurement of maturity by air-flow method.

Module 3: Moisture Absorption and Swelling of Fibres

- Equilibrium absorption of water, humidity and relative humidity, relation between regain and relative humidity, comparative curves for various fibres, heat of sorption, effect of evolution of heat swelling of

fibres, axial swelling, transverse swelling, measurement of swelling, theories of sorption, effect of hydrophilic groups, absorption in crystalline and non crystalline regions, hysteresis – a molecular explanation, structural effects in rayon fibres, structural effects in other fibres, theories of time dependence.

Module 4: Dielectric Properties

- Definition of dielectric properties, effect of frequency, effect of moisture, effect of temperature, static electricity, influence of moisture on resistance, measurement of static charge, and static problems in textile.

Module 5: Optical Properties

- Refractive index and birefringence, measurement of refractive indices,
- Absorption and dichroism, reflection and luster.

Module 6: Mechanical Properties

- Tensile properties; true stress, specific stress, tenacity, breaking length, elastic and plastic deformation, Hooke's law, Poisson's ratio, stress-strain curves, elastic recovery. Torsion of fibers, bending, compression. Strain rate and temperature dependence, creep and stress relaxation.

Module 7: Thermal Properties

- Heat capacity, thermal conductivity, decomposition and degradation, co-efficient of thermal expansion.
- Fibre friction, effect of fibre friction and lubrication.

Lab Outline:

- Determination of microscopic structure (Optical, XRD, SEM), Fibre length, Fibre fineness, Fibre maturity, Fibre moisture regain/content, Fibre tensile properties, Fibre refractive index, Fibre static electricity, Fibre thermal conductivity, Fiber impurities, Interpretation of HVI and AFIS test results, Fibre degradation, Qualitative and quantitative fibre analysis.

Recommended Books:

1. Physical testing of textiles by B. P. Saville, 1999.
2. Fiber Science by Steven B. Warner, 1994
3. Physical Properties of Textile Fibres by John W. S. Hearle and W. E. Morton, 2008
4. Textile Science by E. P. G. Gohl and L. D. Vilensky, 1984
5. AATCC, ASTM and ISO test methods related to the course.

4. Mechanics of Fibrous Structures (2 1 3)

Objectives:

In this course, the students will study about the mechanics of fibrous structures and assemblies, including textile yarns, fabrics and garments and related testing.

Course Contents:

Module 1: Structure, mechanics and testing of yarns

- Physical properties of yarn (Linear density, evenness, imperfections, diameter, hairiness, twist); USTER statistics; Interpretation of yarn evenness testing results; Relationship of fiber properties with yarn properties; Relationship of yarn structure and the its mechanical properties (strength, elongation, elasticity, recovery, modulus).

Module 2: Structure, mechanics and testing of fabrics

- Physical properties and construction of fabric; Relationship of yarn properties with fabric properties; Relationship of fabric structure and the its mechanical properties; Tensile, bending, shear, tear, burst, crease recovery, pilling, abrasion and air permeability of fabrics.

Module 3: Structure, mechanics and testing of garments

- Effect of garment construction on its properties (drape, fit and appearance); Effect of joining methods such as sewing/stitching and types of seam on fabric bending and drape properties.

Lab Outline:

- Determination of yarn linear density, diameter, twist, strength, elongation, friction, imperfections, evenness, hairiness. Comparison of various staple-spun yarn structures; Yarn faults classification.
- Determination of fabric weight, thickness, strength (tensile, tear, bursting) bending, stretch and recovery, air permeability.
- Determination of seam strength, seam pucker, drape, pilling, abrasion and dimensional stability of garments; Evaluation of thermal, moisture and sensory comfort of garments.

Recommended Books:

1. Physical testing of textiles by B. P. Saville, 1999.
2. Structure and mechanics of textile fiber assemblies by P. Schwartz, latest ed.
3. Structure and mechanics of woven fabrics by Jinlian Hu, Woodhead Publishing in Textiles, 2004.
4. Mechanics of Textile and Laminated Composites by A. Bogdanovich and C. Pastore, 1996.
5. Fabric testing by J. Hu, 2008.
6. AATCC, ASTM and ISO test methods related to the course.
7. Quality characterization of apparel by S. Das, 2009.

5. High-performance Fibres

(3 0 3)

Objectives:

In this course, the students will study the second generation of manmade fibers, which became available in the last thirty years. They are high modulus, high tenacity, high thermal and chemical resistant fibers. They are extensively used in the manufacturing of technical textiles and the reinforcement of automobiles and other engineering elements.

Course Contents:

Module 1 Aramid Fibres

- Manufacturing, structure, properties, end uses

Module 2 Polyethylene Fibres

- Manufacturing, structure, properties, end uses

Module 3 Carbon Fibres

- Manufacturing, structure, properties, end uses

Module 4 Glass Fibres

- Manufacturing, structure, properties, end uses

Module 5 Ceramic Fibres

- Manufacturing, structure, properties, end uses

Module 6 Chemical Resistant Fibres

- Manufacturing, structure, properties, end uses

Module 7 Thermally Resistant Fibres

- Manufacturing, structure, properties, end uses

Recommended Books:

1. High-performance Fibers by John W. S. Hearle, 2001
2. High Performance Synthetic Fibers for Composites, National Research Council U. S. A, 1992

6. Environmental Issues of Textile Industry (2 1 3)

Objectives:

The rapid advancements in technology have brought significant comfort in the lives of human being, but the environment is constantly subject to great pressures causing an imbalance in the eco system. The course shall give awareness to the students about the environmental issues particularly related with the textile industry.

Course Contents:

Module 1 Textile & Environment

- Air pollution
- Water pollution
- Noise pollution
- Effect of fiber production & manufacturing industry on environment
- Effect of yarn manufacturing industry on environment
- Effect of fabric manufacturing industry on environment
- Effect of textile processing industry on environment
- Effect of garment manufacturing industry on environment

Module 2 Environmental Management Systems

- ISO 14000

Module 3 Eco-labeling

- Oeko-tex- 100
- EU eco-label

Module 4 Cleaner Production Technologies Related to Textile Industry

- Sources, impact, monitoring, reduction and control of pollution in textile industry

Module 5 Textile Effluents & Waste Management

- Environmental impact assessment
- Environmental audits
- National Environmental Quality Standards
- Textile effluent treatment methods: physical; chemical; biological
- Textile waste management

Module 6 Occupational Health and Safety

- OSHA standards, Personal Protective Equipments.

Lab Outline:

- Determination of air quality, noise level, testing of textile affluent as per NEQS. Testing of textile products as per Oeko-tex-100. Determination of biodegradability of textile materials. Comparison of Organic and Conventional cotton with respect to presence of harmful substances. Determination of Free Formaldehyde release, heavy metals.

Recommended Books:

1. Environmental Engineering by Gerard Kiely, 2007
2. Environmental Impact of Textile: Production Processes and Protection, K. Slatter. 2003
3. Handbook of Sustainable Textile Production. M. I. T. Rohr, 2011.
4. Eco Textiles, M. Mir Aftab, A R Horrocks, 2007
5. Environmental Aspects of Textile Dyeing, R M Christie, 2007

7. Textile Engineering Utilities & Services (3 0 3)

Objectives:

Textile industry consists of different machines and electrical and electronic equipments. The study of lighting systems, humidifiers, air conditioners, compressors and steam and water energy conservations systems will be discussed in detail in this course.

Course Contents:

Module 1 Compressors

Module 2 Air conditioners/Heat Ventilation and Air Conditioning (HVAC)

Module 3 Humidifiers

Module 4 Industrial illumination

Module 5 Fire fighting systems

Module 6 Steam generation systems

Module 7 Steam transportation systems

Module 8 Electricity generation

Module 9 Water and energy conservation in textile industry

Recommended Books:

1. Air-conditioning in Textile Mills by S. P. Patel, ATIRA silver jubilee monographs, 1974
2. Heat Transfer Design Methods by John J. McKetta Jr, 1991
3. Textile Project Management by A. Ormerod, 1992
4. Humidification and Ventilation Management in Textile Industry by B. Purushothama, 2009.

8. Statistical Methods in Textile Engineering (3 0 3)

Objectives:

Variation of quality is one of the most vital features of textile materials, whether raw fibers, yarn, grey fabric or finished cloth, and it is responsible for many problems associated with the use of textiles. Knowledge of statistical method is important for textile engineers because these methods are designed to analyze the essential features of data that indicate variation and draw conclusion on test results.

Note: This course should be taught with the aid of statistical software like MINITAB, SPSS.

Course Contents:

Module 1: Introduction to statistics & probability

Module 2: Acceptance sampling in textiles

Module 3: Measures of central tendency

Module 4: Measures of variation

Module 5: Analysis of variation (ANOVA)

Module 6: Correlation & regression

Module 7: Statistical process control

Module 8: Process control charts

Module 9: Pareto charts

Module 10: Process capability analysis

Module 11: Design & analysis of experiments

Recommended Books:

1. Statistical Methods for Textile Technologists by T. K. P. Norris, L. H. C. Tippett Murphy, 1973.

2. Statistical Methods used in Textile Industry by A. Brearley & D. R. Cox
3. Statistical methods for the Textile Industry by M. Bona, 1993
4. Six Sigma Statistics with Excel and MINITAB by I. Bass, McGrahle, 2007.

COURSE CONTENTS – MAJOR-BASED CORE (BREADTH)

1. Polymer Science and Engineering
2. Introduction to Yarn Manufacturing
3. Introduction to Fabric Manufacturing
4. Introduction to Textile Chemical Processing
5. Introduction to Garment Manufacturing
6. Color Science

1. Polymer Science and Engineering (3 1 4)

Objectives:

- To develop in students an understanding of scientific and engineering principles and properties of polymeric materials used in textiles

Course Contents:

Module 1 Introduction to Polymer Science

- Monomers; oligomers; polymers; types of polymers; thermoplastic and thermoset polymers; polymerization, degree of polymerization; types of polymerization; properties of polymers; molecular weight; weight average molecular weight; number average molecular weight; polydispersity; polymer orientation; testing and characterization of polymers.

Module 2 Polymerization Techniques

- Polymerization techniques (Continuous and discontinuous). Spinning, melt spinning, dry spinning, wet spinning, Drawing, Continuous filament yarns, LOY (Low Oriented Yarn) MOY (Medium Oriented Yarn) POY (Partially or Pre-oriented Yarn) HOY (High Oriented Yarn) FOY (Fully Oriented Yarn). Spinnerets and types of spinnerets. Texturing, false twisting, air texturing, properties of textured yarns. Discontinuous fibers (tow and staple fiber), staple cutting machines, crimper

Lab Outline:

As per curriculum

Recommended Books:

1. Principles of polymer engineering by N. G. McCrum C. P. Buckley, 1997.
2. Introduction to Polymers by R. J. Young, P. A. Lovell, 2011.

2. Introduction to Yarn Manufacturing

(3 1 4)

Objectives:

In this course the students will study brief introduction to blow room, carding, drawing, combing, roving, ring spinning, woolen/worsted spinning systems, auto winding and yarn packing.

Course Contents:

Module 1 Spinning Processes

- Flow charts of spinning processes for filament and staple-spun yarns, carded and combed yarns, jute, flax and spun silk yarn.
- Input and output of each department.
- Intermittent spinning and continuous spinning.

Module 2 Blow Room

- Objectives of blow room.
- Working principles in blow room.
- Study of bale breaker, porcupine opener, various beaters, cage condenser, scutcher and removal of wastes.

Module 3 Carding

- Objectives of carding
- Carding actions
- Working of card
- Role of different parts and their speeds.

Module 4 Drawing

- Objects of drawing frame
- Working of drawing frame.
- Concept of drafting
- Drafting and doubling
- Breaker, inter and finisher drawing frame.

Module 5 Combing

- Objectives of combing
- Noil %age
- Combing preparatory processes
- Working of comber.

Module 6 Roving

- Objectives of roving frame
- Working of roving frame

Module 7 Spinning

- Objectives of ring spinning
- Principle and mechanism of twist insertion
- Working of ring frame

Module 8 New Spinning Systems

- Open-End Rotor spinning
- Air-jet spinning

- Friction spinning
- Wrap spinning
- Compact spinning

Module 9 Woolen Industry

- Wool and its classification
- Woolen and worsted yarn
- Flow charts for woolen and worsted spinning processes
- Wool classification and sorting
- Impurities in wool
- Raw material for woolen industry
- Wool scouring, carbonizing, drying and blending
- Woolen carding and woolen spinning.

Module 10 Worsted Industry

- Worsted carding, backwashing and gilling
- Combing, drawing and spinning.

Module 11 Winding and Yarn Packing

Lab Outline:

- To study the cleaning efficiency of blowroom
- To find the CVm% of the lap sheet in blowroom
- To study the pre-carding zone of carding machine
- To study the carding zone of carding machine
- To study the post-carding zone of card machine
- To study the drafting system at draw frame
- To study the effect of change of number of doublings on sliver CVm%
- To study the block creeling at the draw frame
- To study the drafting system of roving machine
- To study the drafting system of ring machine
- To study the passage of yarn on cone winding machine

Recommended Books:

1. Fundamentals of Spun Yarn Technology by C. A. Lawrence, 2003.
2. The Rieter Manual of Spinning by W. Klein, 2008
3. Manual of Cotton Spinning by Gilbert R. Merrill, 1961
4. Spun Yarn Technology by Eric Oxtoby, 1987.
5. The Woolen & Worsted Industry by Brearley and Iredale, 1977.

3. Introduction to Fabric Manufacturing (3 1 4)

Objectives:

In this course the students will study a brief introduction to important techniques of fabric manufacturing, following the related areas such as techniques of warping, sizing, drawing-in, weaving, types of weaving machines, basic weaves, fabric inspection & mending, and packing.

Course Outline:

Module 1 Basics of Weaving

- History and scope of weaving
- Types of fabrics, woven, knitted, braided, non-woven
- Introduction to weaving technology
- Weaving preparatory processes: warping and its objectives, sizing and its objectives,
- Primary, secondary and auxiliary motions of weaving
- Different shedding systems: tappet, dobby, jacquard
- Different weft insertion systems: shuttle, shuttleless (air-jet, water-jet, rapier, projectile)
- Types of take-up motions & let-off motions
- Weave presentation, repeat, draft, peg plan and reed plan,
- Weave designs: plain weave and its derivatives, twill weave and its derivatives, construction of satin and sateen weaves.

Module 2 Basics of Knitting

- History and scope of knitting
- Introduction to knitting, machine knitting elements, beard latch and compound needles.
- Classification of knitting machines, principles and mechanism of weft knitting, knit tuck and loop formation, usage of different knit loops, properties of plain and rib fabrics, properties of purl and interlock fabrics
- Introduction to warp knitting, mechanism of loop formation in warp knitting, classification of warp knitting machines, basic warp knitted structures, stitch notation of warp weft knitted structure
- End usage of warp knitted structures

Module 3 Braiding

- Introduction to braid technology and its application, Maypole braiding machine, Flat and circular braiding machines, Horizontal and vertical braiding machines, Take-up mechanism
- Machine components, Bobbins, Yarn carriers, The braiders deck,
- Braided structures, Flat and Circular braid structures, Over-braid (braiding over a core/mandrel)

Module 4 Nonwovens

- Introduction to nonwovens, Range of applications, Classification of nonwoven: web formation and consolidation, Classification of consolidation processes
- Needle punching, Spunlaced wovens, Adhesive bonding, Thermal bonding, Stitch bonding, End uses

Lab Outline:

- To study the operation of automatic winding machine
- To study the passage of yarn through pirn winding machine.
- To study the operation of warping machine
- Study of creels used in warping machines

- To study the passage of yarn through sizing machine.
- Demonstration of construction and working of sizing equipment and sizing machine
- To study the passage of yarn through drawing-in & tying-in process.
- To analyze the given sample of cloth.
- To study the passage of yarn through loom.
- To study the operation of Flat Knitting machine.
- To study the operation of Circular Knitting machine.
- To study the layout of a knitting lab.
- To study the passage of yarn through single jersey knitting machine.
- To study the passage of yarn through double jersey (rib and interlock) knitting machine.

Recommended Books:

1. Weaving Conversion of Yarn to Fabric by P. R. Lord & M. H. Mohd
2. Principles of Weaving by R. Marks & A.T.C. Robinson
3. Knitting Technology by D. J. Spencer
4. Woven Cloth Construction by A. T. C Robinson & R. Marks
5. Knitting Handbook: An Instructional Guide to Knitting by Viv Foster, 2004
6. Braiding and braiding machine by W. A. Douglass
7. Specialist yarn and fabric structures Edited by R. H. Gong

4. Introduction to Textile Chemical Processing (3 1 4)

Objectives:

The objective of this course is to introduce the students to different areas of textile chemical processing, including chemical preparation of textiles, textile dyeing, textile printing and textile finishing.

Course Contents:

Module 1 Introduction

- Introduction to textile chemical processing
- Chemical processing flow chart

Module 2 Desizing & Scouring Fundamentals

- Chemical composition of Size and Cotton
- Desizing Techniques and Methods
- Scouring chemicals and Auxiliaries
- Saponification, Dispersion, Suspension and Emulsion
- Evaluation of desizing & scouring

Module 3 Bleaching & Mercerizing Fundamentals

- Bleaching Chemicals and auxiliaries
- Bleaching chemistry
- Effect of Mercerization on cotton fiber

Module 4 Dyeing Fundamentals

- Introduction to dyes
- Dyeing of cellulosic fiber with direct, reactive, sulphur and vat dyes
- Dyeing of polyester, nylon, acrylic, wool and silk
- Important characteristics of dyed fabrics

Module 5 Colour Science Fundamentals

- Introduction to specification, measurement and quality control of colour

Module 6 Printing Fundamentals

- Design Studio & Engraving
- Introduction to different methods and styles of printing

Module 7 Finishing Fundamentals

- Classification of finishes: chemical; mechanical
- Introduction to common chemical and mechanical finishes

Lab Outline:

- Survey of Textile Processing Machinery
- Enzymatic desizing of woven cotton fabric by pad batch method
- Scouring of cotton fabric by exhaust method
- Bleaching of p/c blended fabric by pad-steam method
- Mercerization of cotton fabric
- Heat-setting of p/c blended fabric on stenter
- Dyeing cotton with reactive dyes
- Dyeing polyester with disperse dyes
- Dyeing p/c with disperse/reactive dyes by pad-thermosol-pad-steam method
- Printing p/c with pigments by flat screen method
- Printing cotton with reactive dyes
- Application of softeners
- Application of hand-building/stiff finish
- Application of resin finishing
- Application of water and oil-repellent finish
- Denim washing with enzymes and pumice stones

Note: The students should become familiar with different textile processes. They may not be able to design and optimize recipes but know the function of each process auxiliary used and evaluate at least one key characteristics of processed fabric.

Recommended Books:

1. Chemistry and Technology of Fabric Preparation and Finishing by C. Tomasino, 1992.
2. Basic Principles of Textile Coloration by A. D. Broadbent, 2005.
3. Cellulosic Dyeing by John Shore, Society of Dyers and Colorists, 1995
4. Dyeing of Textile Materials by Jose Cegarra, Textilia, 1992
5. Textile Printing by W. C. Miles, Society of Dyers & Colorists, 2003

6. Textile Finishing by Derek Heywood, Society of Dyers & Colorists, 2003

5. Introduction to the Garment Manufacturing (3 1 4)

Objectives:

In this course the students will study a brief introduction to clothing, clothing measurements, clothing sizes, pattern makings, sampling, cutting, induction, stitching machines, stitching, trimming, finishing, packing.

Course Contents:

- Overview of the garment industry of the world and Pakistan
- Flow-charts for apparel product development process for different articles
- Apparel sizing and measurements
- Pattern making
- Fabric spreading and cutting
- Sewing and other textile joining methods
- Types and components of sewing machines
- Fundamentals of sewing process
- Garment washing, finishing pressing and packing
- Garment quality control: performance, appearance, fit and comfort
- Garment care labeling

Lab Outline:

- Study of the different parts of a Lockstitch and Over lock Sewing Machines.
- Study of the Bobbin Winding, Needle Threading and setting of bobbin into the bobbin case of a Lockstitch Sewing Machine.
- Study of the different parts of a Flat Lock (Cover stitch) Sewing Machine.
- Study of the threading of 3 Thread Over lock and 4 Thread Over lock Sewing Machine.
- Study of the threading of 3 Needle 5 Thread Flat lock (Cover stitch) Machine.
- Study of the Main Frame and Cover Components of a Vertical Straight Knife Cutting Machine.
- Study of the basic Sewing Machine Operation.
- Study of the Stitching: Exercise – I on Paper using Practice Sheet – 1.
- Study of the Stitching: Exercise – II on Paper using Practice Sheet – 2 (D Series).
- Study of the Stitching: Exercise – III using a Fabric Swatch.
- Study of the Stitching: Exercise – IV using Paper & Fabric Swatch.
- Study of various Stitch Types (Class 100, 300, 400, 500, 600)
- Study of Pressing Effect on different Types of Fabrics.
- Study of the Basics of CAD System.

Recommended Books:

1. Introduction to Clothing Manufacture by Gerry Cooklin
2. Clothing Technology for Fashion Designers by Gerry Cooklin
3. Clothing by Jeanette Weber
4. Apparel Manufacturing: (Sewn Product Analysis) by Ruth E. Glock, Grace I. Kunz 4th Edition 2004.
5. Clothing Technology by Eberle, H. Verlag Europa- Lehrmittel, 2002.
6. Fashion from concept to consumer by Frings, Gini Stephens, Prentice Hall, 1999.

6. Colour Science

(2 1 3)

Objectives:

In this course the students study fundamentals of colour perception, description, notation, communication and measurement. The course covers topics such as elements of colour perception, standard illuminants, specification of color, Munsell system, CIELAB system, color difference, pass/fail system, shade sorting, strength analysis of dyes from solution, relative dye strength and tone analysis, assessment of whiteness and degree of yellowness, anatomy of colour measuring instruments, and principles of computer colour matching. The course also includes lab practice exercises in color matching.

Course Contents:

Module 1 Introduction

- Importance of colour in textiles
- Application of colour science in textiles
- Elements of colour perception: light, object, observer
- Standard illuminants
- Major types & characteristics of textile objects
- Visual perception and defective colour vision

Module 2 Specification of Colour

- Subjective methods of colour specification
- Objective methods of colour specification
- Opponent color coordinates and the L a b Concept
- Lightness Chroma and Hue
- Some Practical Application based On the L a b C h System

Module 3 Measurement of Colour

- Anatomy of a Spectrophotometer: Illumination, Optics, Sample Presentation and Viewing Geometry, Monochromation, Photodetection
- Major types of spectrophotometers: desktop spectrophotometer; portable spectrophotometer; on line spectrophotometer
- Effect of viewing geometry, sample size, specular component and different instruments on colour
- How to select a spectrophotometer for process house?

- Color quality control system
- Recipe prediction and related programs
- Color analysis methods and systems in textile mills
- Color analysis hardware and software in various color systems
- Review of recent developments in measurement, communication, management and analysis of colour
- Application of color measuring systems
- Color management systems

Module 4 Measurement of Color Difference

- Acceptability and Perceptibility
- Different color difference formulae
- Which color difference Formula?
- Grey Scale and color Difference
- Practical experience in shade evaluation
- Setting up tolerance limits

Module 5 Assessment of Whiteness and Degree of Yellowness

- Formulae for Computing Whiteness Indices
- Which Whiteness Formula?
- Yellowness Index

Module 6 Shade Sorting

- Why shade sorting?
- How shade sorting differs from pass-fail?
- Shade sorting according to 555 system

Module 7 Strength Analysis of Dyes from Solution

- Lambert-Beer Law
- Practical Applications of Beer's Law
- Determining Strength Ratios from a Mixture of Dyes
- Transmission Measurements of modern color system
- Relative dye strength and tone analysis
- Comparison of different methods & practical examples

Module 8 Computer Color Matching

- Theory of Computer Colour Matching
- Accuracy of Match Prediction
- Preparation of Database
- Sampling of Dye
- Calibration Dyeing
- Data Verification and Rectification
- Measurement of Reflectance
- Processing Variables
- Compatibility of Dyes
- Variations in Dye Strength
- Batch Correction
- Tristimulus Color Matching
- Utilisation of Leftover Dyes
- Benefits from Computer Colour Matching

Module 9 Reproducibility & Right First Time Dyeing

- Factors affecting reproducibility and right first time dyeing

Lab Outline:

- To Split White Light into Coloured Beams of its Spectrum
- To Perform and Understand the Concept of Additive Colour Mixing
- To Perform and Understand the Concept of Subtractive Color Mixing
- To Assess the Colour Difference Visually between Two Colored Materials
- To Evaluate the Colour Difference Instrumentally Between Two Colored Materials
- To Determine Metamerism Between Two Coloured Materials
- To Determine Colour Strength of Dyed/Printed Material in Terms of Absorption/Scattering Ratio (K/S)
- To Determine Transmission, Absorbance and Colour Strength of a Colored Solution Using Transmission Spectrophotometer
- To Prepare the Database of Colours and Material in a Reflectance Spectrophotometer in Order to Determine Match Predictions
- To Determine Colour Recipes in Order to Match Colour of the Material with a Particular Standard
- Color/Shade matching
- To Determine Whiteness Index of the Material Using Reflectance Spectrophotometer
- Defective Colour Vision Test

Recommended Books:

1. Computer Colour Analysis by A. D. Sule
2. Measurement of Colour by W. D. Wright
3. Textile Science by E. P. G. Gohl
4. Instrumental Colour Formulation by James Park
5. Colour and its Application by F. W. Culolow
6. Colour in Theory and Practice by H. D. Murrey
7. Colour in Business and Industry by Dean B Judd
8. Assorted Colour Literature by Datacolor, Macbeth, Hunterlab, X-Rite

COURSE CONTENTS – TEXTILE ENGINEERING (DEPTH)

Textile Engineering Elective – I

- 1. Pre-spinning Processes-I**
- 2. Weaving Preparatory Processes**
- 3. Pre-treatment of Textiles**
- 4. Garment Sizing and Pattern Making**

1. Pre-spinning Processes-I (2 1 3)

Prerequisites:

Introduction to Yarn Manufacturing

Objectives:

In this course students will be given in-depth knowledge of machinery related to blow-room and carding. Latest innovations in the machines and their workings will be discussed in detail.

Course Contents:

Module 1 Blow room

- Basic principles of the blow room. Raw material, re-usable waste, Acclimatization of the raw material. Blow room installation as a sequence of machines. The components of blow room machines, feeding apparatus, opening devices, grid and their interaction. General factors influencing opening and cleaning. Description of pre-cleaning and fine-cleaning machines of conventional and modern blow rooms. Blending purpose, evaluation and types of blending operations. Structure and functioning of blow room scutcher. Transport of material, mechanical transport, Pneumatic transport, control of material flow. Machine damage prevention and fire protection, metal detection. Foreign Contamination detection and removal system; Waste management; Evaluation of blow room output material. Running and cleaning efficiency. Optimum process atmospheric conditions.

Module 2 Carding Process

- Carding principles; the objectives of pre-carding, carding and post-carding zones; the operating zones of the card; feed device, taker-in zone, auxiliary carding devices (carding aids), main cylinder, flats, doffer, the detaching apparatus, can coiler; the machine drive. Card clothing, grinding and geometry of card clothing. Integrated grinding system (IGS).Auto-leveling equipment, Principles of short-term, medium-term and long-term auto-leveling, machine settings and auxiliary equipment, Running and cleaning efficiency; Evaluation of card sliver. Optimum process atmospheric conditions.

Lab Outline:

- Sketching the layout side view plan of Blow room line along with waste disposal and filter system.
- Detail Study of the working of Blow room machine in relation to setting, speed, performance.
- Determination of fibre content of wastes using Shirley Analyzer
- Determination of cleaning efficiency and fibre growth of Blow Room
- Study of electric piano motion and lap doffing machine.
- Study of lap making, calendaring and hardening mechanisms.
- Determination of waste %age of Blow Room machines.
- Determination of cleaning efficiency and fiber growth of card machine.
- Setting of flats with respect to cylinder at card machine.
- Setting of carding parts relative to each other.
- Study and analysis of various card clothing.
- Study of the defects and remedies of card sliver
- Study the web at carding machine and determination of the neps in web
- Study of auto leveling system installed on card machine

Recommended Books:

1. The Rieter Manual of Spinning by W. Klein, 2008
2. Fundamentals of Spun Yarn Technology by C. A. Lawrence, 2003.
3. Spun Yarn Technology by E. Oxtoby, 1987.
4. Advances in Yarn Spinning Technology by C. A. Lawrence, 2010.
5. Manual of Cotton Spinning by Textile Institute Manchester, UK.
6. Manual of Cotton Spinning by Gilbert R. Merrill. 1961

2. Weaving Preparatory Processes (2 1 3)

Prerequisites:

Introduction to Fabric Manufacturing

Objectives:

The objective of this course is to familiarize students about different weaving preparatory processes including warping and sizing and drawing-in.

Course Contents:

Module 1 Winding

- Introduction to Winding process, its objectives, Technical requirements of the winding process, Factors effecting production of winding machine. Density & stability of package Different types of winders: Non-automatic and Automatic winding machines, Weft winding process, types of packages used in fabric manufacturing. Calculation for speed transmission of winding machines, production and efficiency.

Module 2 Warping

- Introduction to Conventional and sectional warping. Latest development in warping machines, Creels and their types (V and parallel). Costs of Beam warping, Tension control in warping, production, yarn breakage rate, efficiency and speed of warping machines.

Module 3 Sizing

- Introduction to sizing machines, study of machine parts & their functions, types of sizing machines. Beam creel & types of beam creel, Drive of sizing machine, PIV mechanism Calculation for yarn breakage rate in sizing process, production and efficiency of sizing machines.
- Properties of different sizing materials (sizing ingredients, aqueous sizes, solvent sizes, dye sizing and indigo dye sizing) and their use for different types of yarns; Sizing recipe and mixing procedure, Size additives; Size liquor pick up & factors governing it; Sizing of terry towels & open-end yarn; Wastages & losses in sizing process, use of after waxing system, viscosity measurement of sizing liquor. Calculation of recipe for different types of cookies. Calculation for the count of sized yarn.

Module 4 Drawing-in and knotting

- Introduction to drawing-in system. Drawing-in accessories: draw hooks, reed knife; Knotting process. Article change of weaving machine. Automatic and manual drawing-in.

Lab Outline:

- Determine the package density of different types of Packages.
- Calculate the production of auto winder.
- To study pneumatic and suction supply on auto winder & make line diagram.
- To determine the winding angles in the wound packages.
- To determine the creel angle, creel waste, wing angle & tension on warp thread. Also determine the beam capacity of warp beam.
- To study the drive on high speed warping machine. Also study the speed change & hydraulic mechanism on high speed warping machine.
- To study section building mechanism on section warping machine. Determine the yarn capacity of swift.
- To study the drive of section warping machine. Determine the surface speed of swift, weavers beam, threaded rod & study the measuring gauges.
- Drive of sizing machine and specification of different rollers.
- To study the steam supply system on drying cylinders, size box and size cooker.
- To calculate capacity of weaver's beam of size % is 12 and density is 0.65 gm/Cm^3 and recipe formulation for sizing machine.
- To study the hydraulic mechanism on sizing machine.
- To study knotting & drawing in process and draw the passage.

Recommended Books:

1. Weaving: Conversion of Yarn to Fabric by P. R. Lord and M. H. Mohamed, 1982
2. Handbook of Weaving by Sabit Adanur, 2000
3. Eurotex-An introduction to Textiles by R. Marks
4. Weaving Technology and Operations by Allan Ormsrod
5. Cotton Weaving, Its Development, Principles and Practice by Richard Marsden, 2000

3. Pretreatment of Textiles

(2 1 3)

Prerequisites:

Chemistry–II, Textile Raw Materials and Introduction to Textile Chemical Processing.

Objectives:

In this course, the students will study in depth different preparatory processes to which textile materials are subjected before dyeing, printing and finishing. Students will learn in detail, the preparation of natural, manmade and blended textile materials in various forms. Students will develop understanding on rationale, principles, mechanisms, effect and control of various process parameters, most common problems, and their preventative and corrective measures. The course also includes lab practice.

Course Contents:

Module 1 Greige Inspection & QC

- Greige receiving and Recording
- Greige faults and their grading systems
- 2-point and 10-point System
- Fabric inspection machinery and its description
- Fabric packing & storage

Module 2 Shearing & Singeing

- Principle, method and machinery for shearing
- Principle, method and machinery for singeing
- Common shearing & singeing faults and their countermeasures
- Testing & Q.C. of singed & sheared fabric
- Faults and remedies

Module 3 Desizing

- Principle, method and machinery
- Chemical composition of Sizes and their identification
- Desizing mechanisms and methods
- Desizing Recipes & Process Design
- Testing & Q.C. of Desized fabrics
- Faults and remedies

Module 4 Scouring

- Principle, method and machinery
- Mechanism of scouring
- Chemical and bio-scouring of cotton, flax, jute, wool, manmade fibers and their blends
- Scouring Recipes & Process Design
- Testing & Q.C. of scoured textiles
- Faults and remedies

Module 5 Heat-setting

- Principle and machinery
- Mechanism of heat-setting
- Dimensional stability of synthetic fiber
- Structural changes taking place in fiber during heat treatment
- Methods of heat setting
- Heat-setting Process Design
- Testing & Q.C. of heat set fabrics
- Faults and remedies

Module 6 Bleaching

- Principle, method and machinery
- Mechanism of Bleaching
- Chemistry and mechanism of different bleaching agents: Hydrogen peroxide; Sodium hypochlorite; Sodium Chlorite; bio
- Bleaching of cotton, flax, jute, wool, manmade fibers and their blends
- Bleaching Recipes & Process Design
- Testing & Q. C. of bleached textiles
- Faults and remedies

Module 7 Mercerization & Causticization

- Principle and methods
- Mechanism and effects of Mercerization
- Yarn and Fabric Mercerization
- Slack & Tension Mercerization both in the cold and hot conditions
- Mercerization machines and their description
- Caustic Weight reduction of Polyester
- Mercerization & Causticization Process Design
- Testing & Q. C. of Mercerized textiles
- Faults and remedies

Module 8 Liquid Ammonia Treatment

- Cotton treated with Liquid Ammonia
- Physical and chemical modification taking place during the process
- Liquid Ammonia treatment machinery and its description
- Testing & Q. C. of Ammonia treated fabrics
- Faults and remedies

Lab Outline:

- Enzymatic desizing of cotton and P/C woven fabrics by exhaust method
- Enzymatic desizing of cotton and P/C woven fabrics by pad batch method
- Enzymatic desizing of cotton and P/C woven fabrics by pad steam method
- Oxidative desizing of cotton and P/C woven fabrics by exhaust method
- Oxidative desizing of cotton and P/C woven fabrics by pad batch method
- Oxidative desizing of cotton and P/C woven fabrics by pad steam method
- Scouring of cotton and P/C knitted fabric by exhaust method using alkali and detergents on winch machine
- Scouring of cotton and P/C knitted fabric by exhaust method using enzymes
- Two-step Scouring and Bleaching cotton and P/C yarn in package form using Caustic Soda and Hydrogen Peroxide
- One-step desizing and scouring of woven cotton and P/C fabrics by exhaust method
- One-step desizing and scouring of cotton and P/C woven fabrics by pad steam method
- One-step desizing, scouring and bleaching of cotton and P/C fabrics by pad steam method
- Scouring and bleaching of wool
- Scouring and bleaching of Jute
- Cold mercerization of bleached cotton fabrics
- Hot Mercerization of grey cotton fabric, followed by desizing, scouring and bleaching
- Caustic treatment of 100% polyester and P/C blended fabrics
- Heat setting of Polyester, Polyester/elastane and cotton/elastane blends

Note: The students should become able to identify required chemicals and auxiliaries, design recipes and process conditions, monitor and control process conditions and evaluate the processed fabric.

Recommended Books:

1. Chemical Technology in the Pretreatment Processes of Textiles by S. R. Karmakar, 1999.
2. Cellulosic Dyeing by John Shore, 1995
3. Chemistry and Technology of Fabric Preparation & Finishing by Charles Tomasino, 1992
4. Textile Chemistry by R. H Peters
5. Scouring and Bleaching by E. R. Trotman

4. Garment Sizing and Pattern Making (2 1 3)

Prerequisites:

Introduction to Garment Manufacturing

Objectives:

This course is about the fundamentals of apparel manufacturing. Different types of machines, their automations and the computer aided software related to the stitching machines will be discussed in detail.

Course Contents:

- Introduction to anthropometry and human figure
- History of sizing systems and ready-to-wear
- Sizing systems and standardization
- Creating sizing systems
- Function, fit and aesthetics in sizing
- Communication of sizing and fit
- Materials and sizing
- Mass customization and sizing
- Sizing for military
- Pattern making essentials for the workroom
- Form measurement and figure analysis
- Drafting the basic pattern set
- Dart manipulation
- Designing with darts
- Style lines
- Added fullness
- Yokes, flanges, pin tucks and pleat tucks
- Contouring principle
- Collars, built-up necklines, cowls, skirts/circles and cascades, sleeves, drop shoulders, armholes
- Pattern making considerations for menswear
- Pattern making considerations for womenwear
- Pattern making considerations for childrenwear
- Pattern grading

Lab Outline:

- To Construct the pattern of Band Collar
- To Construct the pattern of band collar with button extension
- To Construct the pattern of Pointed bottom
- wing collar (curved Neckline)
- To Construct the pattern of sewing practice of collar
- To Construct the pattern of two piece short collar
- To Construct the pattern of one piece shirt collar
- To Construct the pattern of sleeve placket
- To Construct the pattern of round corner cuff
- To Construct the pattern of straight corner cuff

- To Construct the pattern of patch pocket
- To Construct the pattern of patch pocket with flap
- To Construct the pattern of basic bodice block (back panel)
- To Construct the pattern of basic bodice block (front Panel)
- To Construct the pattern of basic sleeve block
- Main bodice blocks on $\frac{1}{4}$ scale
- Truing of basic bodice blocks
- To Construct the pattern of dart manipulation
- Basic skirt block
- To Construct the pattern of Sewing practice of pleats

Recommended Books:

1. Dress Pattern Designing by Natalie Bray
2. Clothing Construction by Evelyn A. Mansfield, 1953
3. The Bishop Method of Clothing Construction by Edna Bryte, Arch, Marjorie Stotler Arch, 1966
4. The Bishop Method of Clothing Construction by bishop/arch, 1959.
5. Clothing: Fashion, Fabrics & Construction, Student Text by Jeanette Weber and McGraw-Hill, 2002.
6. Clothing Construction by Mary Jo Kallal, 1985.
7. Sizing in clothing by S. Ashdown, woodhead publishing 2007.
8. Patternmaking for Fashion Design (*Fourth Edition*) by Helen Joseph – Armstrong 2010. Prentice Hall,
9. Apparel Manufacturing: (*Sewn Product Analysis*) Ruth E. Glock , Grace I. Kunz, Prentice Hall, 2000.
10. Dress Pattern Designing (*Fifth Edition*) by Natalie Bray, Blackwell Science, 1999.

COURSE CONTENTS – TEXTILE ENGINEERING (DEPTH)

Textile Engineering Elective – II

- 1. Pre-spinning Processes-II**
- 2. Weaving Mechanisms**
- 3. Dyestuff Chemistry**
- 4. Industrial Cutting and Sewing**

- 1. Pre-Spinning Processes – II (2 1 3)**

Prerequisites:

Introduction to Yarn Manufacturing, Pre Spinning Processes-I

Objectives:

In this course students will be given in-depth knowledge of machinery related to Draw frame, Lap former and comber. Latest innovations in the machines and their workings will be discussed in detail.

Course Contents:

Module 1: Lap Forming Process

- Lap former, preparation of stock for combing, conventional and modern preparation system. Evaluation of sliver lap. Optimum process atmospheric conditions.

Module 2: Combing Process

- Combing principles. Sequence of operations in a rectilinear comber. Combing theory. Technology of combing. Comber feeding, nipper assembly, comb, detaching rollers, piecing, sliver take-off, the drafting arrangement, coiling the sliver, waste removal. Automation in the combing section. Comparison of carded and combed slivers. Optimum process atmospheric conditions.

Module 3: Drawing Process

- Task of the draw frame; Theory of roller drafting; equalizing, parallelizing, blending, dust removal, creel (sliver feed), the drafting arrangement, coiling, the delivery arrangement, condensing, sliver coiling, can changers. Auto-leveling at draw frame. Evaluation of draw frame sliver. Optimum Process atmospheric conditions.

Lab Outline:

- Study of drafting systems at draw frames
- Study of count control at draw frame
- Setting of drafting rollers at drawing frame
- Comparison of weight regularity of slivers before and after drawing
- Observing the blending effect of at various Draw Frame passages
- Study of auto-leveling setting at draw frame and its effect on sliver quality
- Study of auto can changing system and count meter
- Study of nippers, combing cylinder
- Study of comber waste determination and alteration
- Study of swinging of nippers at comber machine
- Study of eccentricity of top drafting rollers and its measurement
- Study of waste collection on draw frame
- Study of forward and backward movement system of detaching rollers
- Study of drafting and coiling system

Recommended Books:

1. The Rieter Manual of Spinning by W. Klein, 2008
2. Fundamentals of Spun Yarn Technology by C. A. Lawrence, 2003.
3. Spun Yarn Technology by E. Oxtoby, 1987.
4. Advances in Yarn Spinning Technology by C. A. Lawrence, 2010.
5. Manual of Cotton Spinning by Textile Institute Manchester, UK.
6. Manual of Cotton Spinning by Gilbert R. Merrill. 1961

2. Weaving Mechanisms

(3 1 4)

Prerequisites:

Introduction to Fabric Manufacturing, Weaving Preparatory Processes

Objectives:

- The objective of this course is to develop an understanding in students about different weaving mechanism related with primary, secondary and auxiliary motions

Course Outline:

Module 1 Shedding systems

- Introduction to shedding mechanism and types of shedding mechanism, Tappet shedding mechanism, Types of tappets, Design of tappet, Dobby shedding mechanism, Types of Dobby. Jacquard shedding mechanism, Working of different parts of jacquard mechanism, Types of jacquards. Tappet shedding: mechanism; merits and demerits; positive and negative cams.

Module 2 Weft insertion systems

- Weft insertion system, Conventional shuttle weft insertion system; automatic weft insertion system; bobbin change mechanism; pirn winding mechanism, projectile weaving machine.
- Speed and weight of the projectile, projectiles for different types of yarns, torsion rod mechanism, projectile opener, lifter, gripper. Picking and receiving units. Picking force of the projectile. Guide teeth and their settings. Conveyor chain. Projectile lubrication system. Weft mixer system

Module 3 Let off Mechanism

- Explain let off motion. Types & objective of let off motion. Discuss effect of warp tension in let of motion. Sketch construction of positive let off motion. Discuss working of positive let off motion. Draw construction of electronic let off motion & explain its working .Formulate relationship b/w beam diameter & RPM of weavers beam.

Module 4 Take-up Mechanism

- Discuss types & objective of take up motion. Demonstrate construction & working of take up motion on shuttle loom. Sketch construction & working of take up motion on projectile loom. Formulate relation for weft density on shuttle & projectile loom. Discuss periodicity due to eccentricity in take up motion.

Module 5 Beat-up Mechanism

- Beat-up mechanism of conventional looms; principle and working of crank beat-up; 4-bar linkage mechanism; Determine throw of crank in crank beat up motion. Demonstrate principle, working and construction of Cam beat up motion. Comparison b/w crank & cam beat up motion and Sley eccentricity

Module 6 Stop Motions

- Explain the types and objectives of warp stop motions. Demonstrate construction & working of electrical warp stop motion. Explain weft stop motion. Discuss electrical weft stop motion. Explain warp protector motion. Discuss types of weft stop & warp protector motion.

Lab Outline:

- To study the negative shedding motions on shuttle loom. Note the functional degrees and specifications of different parts.
- To determine the shed angle and sweep of sley on projectile and shuttle loom.
- To study the different parts of cam and crank beat up motion. Note the functional degree and calculate the throw of crank. Also determine sley eccentricity for crank beat up motion and draw graph between degree and throw of crank.
- Principles operation and setting of Dobby shedding mechanism
- To study different parts in over and under picking shuttle mechanism & note the functional degree. Also calculate power required for picking at each mechanism. Also dismantle the picking tappet in over picking mechanism.
- To study different parts of projectile picking, make diagrams and note specifications.
- To study different parts of Air jet weft insertion and note different specifications and setting of parts.
- To study the negative and positive let off motions on shuttle looms. Calculate breaking force at different positions of negative let off motion.
- To determine the unwinding rate of weaver's beam = 400 mm
- To study electronic let off motion on air jet machine and make the diagram of the following assembly.
 - a. Drive to weaver's beam
 - b. Easing motion
 - c. Back rest assembly
- To study different parts involved in take up motion on shuttle and shuttle less looms. Note the specifications and calculate the picks/inch for each mechanism and also draw the drive mechanism of take up motion on 3 looms.
- To study different parts of rapier picking, note specifications and also study the picking cycle.
- To study the fast reed warp protector motion on shuttle loom, note the functional degrees and make diagram of different parts.

Recommended Books:

1. Weaving: Conversion of Yarn to Fabric by P. R. Lord and M. H. Mohamed, 1982
2. Eurotex-An introduction to Textiles by R. Marks
3. Weaving Technology and Operations by Allan Ormsrod
4. Textile Mathematics, Vol. I, II, III by J. E. Booth

3. Dyestuff Chemistry

(3 1 4)

Objectives:

- This course aims at developing in students an understanding about the colour and chemical constitution of different types of colorants. The main focus of the course is on the relationship of dye chemistry and its properties.

Course Contents:

Module 1: Color and Chemical Constitution

- Early attempts to classify dyes and pigments, introduction to color index classification, color and its relation to dye chemical structure, resonance and orbital theory of color. Development of first synthetic dye mauveine, era of synthetic manufacturing.

Module 2: Dye Manufacturing Process

- Sulphonation, nitration, amination, alkylation, hydroxylation, diazotization and coupling mechanism of various compounds and use of coupling components. Machinery involved in dyestuff manufacturing including autoclave, filter press, reactor and chillers.

Module 3: Dyestuff Classification

Chemical Class:

- Azo, anthraquinone, indigoid, polycyclic, aromatic, carbonyl, polymethine, azine, thiazine, xanthene, thiazole, quinolone, sulphur and cyanine dyes.

Application Class:

- Direct, Reactive, Sulphur, Vat, anthraquinone and solubilized vat dyes, disperse, acid and basic dyes.

Module 4: Pigments

- Classification and properties of pigments viz. inorganic and organic pigments.

Module 5: Fluorescent Brightening Agents

- Introduction of FBAs, Mode of action, chemistry and application of FBA.

Lab Outline:

- To Identify Dyestuff in Dyed / Printed Textile Materials
- To Determine the Dispersion or Brownian Motion of Colorants
- To Evaluate the Colorant Migration in a Pad Dry Continuous Process
- To Determine the Foaming Behavior of Colorants
- Basic diazotisation and coupling reactions
- Testing Method of Colorfastness to Artificial Light (Xenon Arc Fading Lamp Test ISO 105 – B02)
- Testing Methods of Colorfastness to Washing (ISO-105 Group C: Test 1 (Part C01) to Test 5 (Part C05))
- Testing Methods of Colorfastness to Dry-Cleaning (ISO 105 – D01)
- Testing Method of Colorfastness to Water (ISO 105 – E01)
- Testing Method of Colorfastness to Sea Water (ISO 105 – E02)

- Testing Method of Colorfastness to Chlorinated Water (ISO 105 – E03)
- Testing Method of Colorfastness to Perspiration (ISO 105 – E04)
- Testing Method of Colorfastness to Rubbing (ISO 105 – X12)
- Testing Method of Colorfastness to Hot Pressing (ISO 105 – X11)

Recommended Books:

1. Colorants and Auxiliaries by John Shore, Vols. I & II, SDC, UK, 2002.
2. Colour Chemistry by Heinrich Zollinger, Weinheim New York, latest edition
3. Reactive Dyes for Textile Fibres by A. Hunter M. Renfrew, SDC, UK, latest edition

4. Industrial Cutting and Sewing (3 1 4)

Objectives:

- To develop the understanding in the students about cutting and sewing principles and techniques used in garment manufacturing.

Course Contents:

- Introduction to cutting room operations
- Initial preparation and quality control for cutting
- Lay planning and marker making
- Principles and methods of textile spreading
- Manual and automated spreading of textile materials
- Manual and automated cutting of textile materials
- Fusing of cut textile components
- Quality control of cut components
- Manual marker making, spreading, and cutting of fabrics with check patterns, motifs, border patterns, pile and narrow lace
- Problems in spreading and cutting of intricate fabrics their prevention
- Sewing and stitching technologies
- Types of seams and stitches
- Factors affecting seam performance
- Adhesive bonding of textiles
- Ultrasonic, laser and radio frequency welding and heat sealing of textiles
- Types and joining of garment accessories

Lab Outline:

- To Construct Trouser block front back panel
- To construct trouser derivatives, shorts
- To construct trouser derivative, pedal pusher
- To construct trouser derivative, Capri
- To Grade trouser block for 3 up & 2 down sizes (manual Grading) front panel

- To Grade trouser block for 3 up & 2 down sizes (manual Grading) back panel
- To Digitize trouser pattern with the help of Accumark
- To Digitize Shirt pattern with the help of Accumark
- Grading of T-shirt in 5 different sizes (CAD)
- Making Crew Shirt Pattern in (PDS)
- Exercise on Tops & Bottom to use measuring PDS Function
- Exercise on Top & Bottom to use edit PDS Function
- Exercise on Top & Bottom to use points & notches PDS function
- Exercise Manual Marker Making
- Computer Aided Marker Making-I
- Computer Aided Marker Making-II
- Analysis of Stitch classes and to apply stitch classes on Fabric.
- Analysis of Seam classes and to apply seam classes on Fabric.
- Analysis of Knitted top for the identification of all types of Seams and Stitches used in its construction.
- Analysis of Denim trousers for the identification of all types of Seams and Stitches used in its construction.

Recommended Books:

1. Industrial cutting of textile materials by I V Nemes, Woodhead Publishing 2012
2. Joining textiles: principles and applications by I Jones, TWI and G. Stylios

COURSE CONTENTS – Textile Engineering (Depth) Textile Engineering Elective – III

1. Yarn Production Engineering
2. Fabric Design and Structure
3. Textile Dyeing
4. Garment Production Machinery

1. Yarn Production Engineering (3 1 4)

Prerequisites:

Introduction to Yarn Manufacturing, Pre-spinning Processes-I, Pre-spinning Processes-II.

Objectives:

In-depth study of ring spinning frame will be discussed in this course. Modern concepts related to drafting, twisting, and package formation on roving frame and ring spinning frame will be focused. Different affects of conditioning and environmental conditions will also be discussed in this course.

Course Contents:

Module 1 Roving Formation

- Roving frame as a production necessity, tasks of the roving. Operating zones of the roving frame, creel, drafting arrangement, aprons, pressure arm, condensers, spacers, spindle and flyer. Imparting twist, winding system. Package formation; Machine drive system, mechanical drive systems and electronic drive systems. Manual and automatic doffing. Accessories and automation, transport of bobbins to ring spinning machine. Evaluation of roving. Optimum process atmospheric conditions.

Module 2 Ring Spinning

- Functions and mode of operation, structure of the machine, bobbin creel, drafting system, top rollers, roller covers, rollers pressure loading, fiber guidance devices. Spindle, thread guide devices, balloon control ring, separators. Ring structure and its functions. Traveller, types, shape, mass and traveler clearer. Machine drive and cop buildup. Automation, the potential for automation. Monitoring systems and auxiliary equipment. Developments in ring spinning; Compact spinning: principle and advantages of compacting. Optimum process atmospheric conditions.

Module 3 Winding

- Objectives; Working principle of yarn winding, Yarn package types and their building; types of winding machines, uniform build up of cones, automatic electronic yarn clearer and its settings. Yarn tensioners, patterning, reasons and their remedies. Yarn fault classifying systems. Basic features of various auto-winders. Latest developments in winding machinery. Optimum process atmospheric conditions.

Module 4 Yarn Conditioning and Packaging:

- Conventional and modern yarn conditioning systems; Merits of conditioning by autoclaves; Impact of yarn conditioning on yarn quality and productivity.

Lab Outline:

- Sketching the line and gearing diagram of the roving frame.
- Study of change of draft and twist on roving frame.
- Study of the change of coils/inch and roving tension at speed frame.
- Preparation of given hank roving at roving frame.
- Study of package building mechanism at roving frame.
- Sketching the line and gearing diagram of Ring frame
- Study the change of draft and twist on ring frame.
- Study of drafting system of ring frame.
- Study of the cop building mechanism on ring.
- Study of the change of roller settings on ring frame.
- Study of the settings of spindle gauge, balloon height and lappet guide.
- To study the effect of cone winding on yarn quality
- To study the settings of yarn cleaner

- To check the weight gained by cotton yarn during yarn conditionings (yarn steaming) processes using a yarn conditioning machine

Recommended Books:

1. Fundamentals of Spun Yarn Technology by C. A. Lawrence, 2003.
2. The Rieter Manual of Spinning by W. Klein, 2008
3. Advances in Yarn Spinning Technology by C. A. Lawrence, 2010.
4. Spun Yarn Technology by Eric Oxtoby, 1987.
5. Manual of Cotton Spinning by Gilbert R. Merrill, 1961.

2. Fabric Design & Structure

(3 1 4)

Prerequisites:

Weaving Mechanisms

Objectives:

The students will learn about important concepts of fabric structure, different types of weave designs, computer aided weave designs and use of color in weave designs as well analysis of construction and design of already woven fabric. They will also learn about simple but important weight calculations and concept of cover of fabric.

Course Outline:

Module 1 Basic weaves

- Introduction to common weaves: Plain, Twill weaves and its derivatives, satin & sateen weaves and others, Use of design paper for weave design, drafting and lifting plan construction.

Module 2 Dobby Design

- Bedford cords, high-low cords, herringbone and Brighton honey comb.

Module 3 Jacquard Designs

- Limitations of doobby designs, flower designs, design of large repeats. Single thread jacquard designs.

Module 4 Crepe Weaves

- Introduction to crepe weaves and different types of crepe weaves

Module 5 Design of Compound Weaves

- Pile fabrics and their weaves, Warp pile structure. Weft pile weaves. Velvets, Plush and velveteen, Terry fabrics and their weaves. Calculation for towels. Double cloth and their weaves. Multilayer fabric, Tri-axial weave, Carpet.

Module 6 Color and Weave Effect

- Hairline effect, single double and multi hairline effects, step effect, allover effect, hound's tooth effect. Combined color and weave effects.

Module 7 Multilayer Fabrics:

- Types of multilayer fabrics: open width, tubular, single double triple and four layer fabrics. Weave presentation of multilayer designs. Stitching techniques of multilayer fabrics. Extra stitch, raiser and sinker stitch.

Lab Outline:

- Analysis of tappet, dobby and jacquard fabric designs for reproduction:
- Simple: Fabric Analysis Face/Back, Warp/Weft, Ends/Picks
- Fabric Analysis Weave and Design, Crimp and Cover factor
- Fabric Analysis Selvage Type, Yarn Count and Type, Fabric GSM
- Dobby: Fabric Analysis Use of Microscope (Magnifications devices)
- Fabric Analysis and Fabric Construction on Hand Frame Plain or Dobby Design
- Fabric Analysis and Fabric Construction on Hand Frame Dobby design
- Fabric Construction on Hand Loom
- Fabric Analysis and Fabric Construction on Dobby Loom Peg Installation
- Fabric Construction on Dobby Loom Dobby Design Feeding on card
- Fabric Construction on Dobby Loom Dobby Design Feeding on Electronic Dobby
- Fabric Construction on Jacquard Loom Jacquard Design Construction
- Multilayer fabrics analysis
- Different weave analysis by Scot weave

Recommended Books:

1. Textile design and color by Watson
2. Advance Weaving Design by Watson
3. Woven Cloth Construction by R. Marks & A.T.C. Robinson
4. Fabric Structure and Design by N. Gokarneshan, 2005
5. Elementary Textile Design and Fabric Structure by John Read
6. Textile design pure and applied by E.B. Berry
7. Designing woven fabrics by Janet Phillips 2008
8. Manual of Scot Weave

3. Textile Dyeing

(3 1 4)

Prerequisites:

Chemistry–II, Introduction to Textile Chemical Processing and Chemical Pre-treatment of Textiles

Objectives:

In this course the students will study in detail the principles and practice of dyeing natural, regenerated, and manmade fibers and their blends. The students will study classification, chemical structure, basic characteristics and basis of selection of different dyes, dyeing by batch, semi-continuous and continuous dyeing methods and overview of the machinery involved. The course also covers theory of dyeing, dyeing machinery and most common problems encountered in case of dyeing with different dyes by

different dyeing methods, and their preventative and corrective measures. The course also includes lab practice.

Course Contents:

Module 1 Introduction to Dyes and Dyeing

- Brief introduction of dyes and dyeing history
- Essential definitions and terms used in dyeing and their explanation
- Processing flow chart for yarn, woven, denim and knitwear textiles.

Module 2 Theory of Coloration of Textiles

- Relationship between fiber structure and dyes during the dyeing process
- Dyeing Equilibrium: thermodynamic aspects of equilibrium; isotherm and affinities; electrical effects, heat and dyeing entropy
- Kinetics of Dyeing
- Characteristics of dyeing: color fastness

Module 3 Dyeing Machinery

- Fundamentals of functional design of coloration machines
- Exhaust dyeing machines (Fiber dyeing, Yarn dyeing, Fabric dyeing and Garment dyeing)
- Pad dyeing machines

Module 4 Dyeing with Direct Dyes

- Mechanism of dyeing with direct dyes
- Exhaust/batch-wise, semi-continuous and continuous application of direct dyes
- After-treatment of textiles dyed with direct dyes
- Design of recipe and process for dyeing cellulosics with direct dyes
- Faulty dyeing and their correction

Module 5 Dyeing with Reactive Dyes

- Mechanisms of dyeing with dyes of different reactive groups
- Exhaust/batch-wise, semi-continuous and continuous application of reactive dyes
- After-treatment of textiles dyed with reactive dyes
- Design of recipe and process for dyeing cellulosics with reactive dyes
- Faulty dyeing and their correction

Module 6 Dyeing with Vat and Indigo Dyes

- Mechanism of dyeing with vat dyes
- Exhaust/batch-wise, semi-continuous and continuous application of vat dyes
- Dyeing of denim yarn with indigo dyes
- After-treatment of textiles dyed with vat dyes
- Design of recipe and process for dyeing cellulosics with vat dyes
- Faulty dyeing and their correction

Module 7 Dyeing with Sulphur Dyes

- Mechanisms of dyeing with sulphur dyes

- Exhaust/batch-wise, semi-continuous and continuous application of sulphur dyes
- After-treatment of textiles dyed with sulphur dyes
- Design of recipe and process for dyeing cellulosics with sulphur dyes
- Faulty dyeing and their correction

Module 8 Selection of Dyes for Cellulose

- Properties of dyes on the basis of their colour constitution
- Behavior of different dyes in dyeing processes
- Selection of dyes keeping the colour properties, behaviour, cost factor and application methods in mind
- Customer requirement consideration and its effect on dye selection

Module 9 Dyeing of Polyester and Acetate Materials

- Mechanisms of dyeing with disperse dyes
- Exhaust/batch-wise, semi-continuous and continuous application of disperse dyes
- After-treatment of textiles dyed with disperse dyes
- Design of recipe and process for dyeing with disperse dyes
- Faulty dyeing and their correction

Module 10 Dyeing of Acrylic Textiles

- Mechanisms of dyeing with basic dyes
- Dyeing methods for dyeing acrylic with basic dyes
- After-treatment of dyed acrylic textiles
- Design of recipe and process for dyeing with basic dyes
- Faulty dyeing and their correction

Module 11 Dyeing of Protein and Polyamide Fibres

- Dyes and mechanisms of dyeing protein and polyamide fibres
- Dyeing methods for dyeing protein fibres
- After-treatment of dyed protein fibres
- Design of recipe and process for dyeing protein fibres
- Faulty dyeing and their correction
- Dyeing method for Polyamide fibres including Nylon

Module 12 Blend Dyeing

- Objective and need of blending
- Discussion of commercially important blends
- Dyeing of P/C blend with disperse/vat and disperse/reactive dyes by different methods
- Different routes adopted in continuous dyeing of p/c blend
- Dyeing of other important blends like poly/viscose, poly/acrylic etc.
- Design of recipes and processes for dyeing different blends
- Faulty dyeing and their correction

Module 13 Pigment Dyeing

- Introduction to Pigment Dyeing
- Method used in pigment dyeing
- Difference between pigment dyeing and conventional dyeing
- Binders and cross-linking agents used in pigment dyeing

- Color fastness in pigment dyeing

Lab Outline:

- Dyeing of cellulosic fabric with direct dyes by exhaust method, followed by fastness improvement treatments
- Dyeing of knitted and towel cellulosic fabric with reactive dyes by exhaust method
- Dyeing of woven cellulosic fabric with reactive dyes by pad steam method
- Dyeing cellulosic yarn with reactive dyes by exhaust method in package form
- Dyeing woven cellulosic fabric with vat dyes using pad-steam method
- Dyeing woven cellulosic fabric with vat dyes using pad-jig method
- Dyeing cellulosic fabric with sulphur dyes
- Dyeing Polyester fabric by exhaust method/ HT method
- Dyeing Polyester/Cotton blended knitted fabric using Disperse/Reactive dyes in jet/soft-flow machine
- Dyeing polyester/cotton blended woven fabrics using disperse/reactive dyes by two-stage pad-thermosol-pad-steam method
- Dyeing polyester/cotton blended woven fabrics using disperse/reactive dyes by one-bath, one-stage pad-thermosol-pad-steam method
- Dyeing polyester/cotton blended woven fabrics using disperse/vat dyes by using pad-thermosol-pad-steam method
- Dyeing polyamide fabrics using acid dyes
- Dyeing wool / silk fabric with acid dyes
- Dyeing acrylic fabrics using cationic dyes
- Pigment dyeing of polyester, cotton or blended fabric by pad-dry-cure method

Note: The students should become able to identify required chemicals and auxiliaries, design recipes and process conditions, monitor and control process conditions and evaluate the processed fabric.

Recommended Books:

1. Basic principles of Textile Coloration by A. D. Broadbent, 2005
2. Fundamentals and Practices in Coloration of Textiles by Chakraborty, 2009.
3. Cellulosic Dyeing by John Shore, 1995
4. Dyeing of Textile Materials, by Jose Cegarra, Textilia, 1992
5. Critical Solutions in Dyeing of Cotton Textile Materials by R. Shamey and T. Hussain, 2005
6. Textile Science by E. P. G. Gohl, 1995
7. Chemical Principles of Synthetic Fibre Dyeing by S. M. Burkinshaw, 1995
8. Blends Dyeing by John Shore, 1995
9. Continuous Dyeing of Polyester/Cellulosic Blended Fabric by Sumitomo, 1995
10. Dyeing and Finishing of Polyester Fibers and its Blends, BASF 1990
11. Wool Dyeing, Society of Dyers and Colorists, 1992

12. Theory of Coloration of Textiles, Society of Dyers and Colorists
13. Engineering in Textile Coloration, Society of Dyers and Colorists

4. Garment Production Machinery (3 1 4)

Objectives:

- This course aims at introducing students to different types of garments machinery and their working principles

Course Contents:

Module 1 Basic Concepts and Terms Related To Garment Production Machinery

Module 2 Garment Preparatory Machine: Spreaders, Cutters

Module 3 Types of Industrial Sewing Machine

Module 4 Components and Working of Industrial Sewing Machine

Module 5 Ancillary Mechanism for Industrial Sewing Machine

Module 6 Automation in Sewing Machines

Module 7 Garment Washing, Pressing, Finishing and Packing Machinery

Module 8 Maintenance of Garment Production Machinery

Lab Outlines:

- Study of the Drive Mechanisms of Thread Take-up Lever, Needle Bar, in a Lockstitch Sewing Machine.
- Study of the Drive Mechanisms of Upper Looper, Oil Pump, Upper Knife, Needle Bar, and Thread Take-up lever in an Over lock Stitch Sewing Machine.
- Study of the Lower Looper & Feed Drive Mechanism of an Over locks Stitch Sewing Machine.
- Study of the Drive Mechanisms of Oil Pump, Thread Take-up Lever, Spreader and Needle Bar in a Flat lock (Cover stitch) Sewing Machine.
- Study of the Drive Mechanisms of Looper and Needle Guards in a Flat lock (Cover stitch) Sewing Machine.
- Study of the Main Frame and Cover Components in Vertical Straight Knife Cutting Machine.
- Study of the Feed Drive Mechanism in a Flat lock (Cover stitch) Sewing Machine.
- Study of the Crankshaft Mechanism in a Lockstitch Sewing Machine in relation to the Needle Bar.
- Study of the Thread Take-up Lever Mechanism in a Lockstitch Sewing Machine in relation to the Crankshaft.
- Study of Sewing Machine for Working of Feed & Hook/Looper Mechanism.

- Analysis of Drive Mechanism and relationship between motor rpm, needle reciprocation, movement of thread take-up lever and feed dogs in combination.
- Study and adjustment of different stitch types (Class 100, 300, 400, 500, 600)
- Comparison of Machine adjustment for Knitted and Woven Fabrics.
- Determination of different Stitch Densities and Calculation of Thread Consumption for different Stitch Types.

Recommended Books:

1. Manuals related to Garment Machines

COURSE CONTENTS – Textile Engineering (Depth) Textile Engineering Elective – IV

1. **Advanced Spinning Techniques**
2. **Advanced Weaving**
3. **Textile Printing**
4. **Industrial Engineering in Garment Manufacturing**

1. **Advanced Spinning Techniques** (2 1 3)

Prerequisites:

Introduction to Yarn Manufacturing, Pre-spinning Processes-I, Pre-spinning Processes-II

Course Contents:

In this course students will acquired detailed knowledge of new spinning techniques like rotor spinning, air-jet spinning, friction spinning etc. Latest innovations in the machines will be discussed in detail.

Module 1 Introduction

- Fiber characteristics requirements for different leading spinning technologies, possibilities and limitations of different spinning technologies.

Module 2 Rotor Spinning

- The principle of rotor spinning, structure and operation of the rotor spinning machine, spinning box, package formation, yarn waxing device, operating and monitoring, quality control systems. Machine and transport automation, automatic piecing, automatic package change. Selection and influence of draft and yarn twist. Economics of rotor spinning. New developments in rotor spinning. Optimum process atmospheric conditions.

Module 3 Air-jet Spinning

- Principle of operation, raw material requirements, drafting unit, spinning nozzle, winding, automation, yarn structure and properties. False twist and its structure, downstream processing and end products; Economics. Comparison of air-jet and vortex spinning systems. Optimum process atmospheric conditions.

Module 4 Friction Spinning

- Principle and raw material preparation, process and machine parameters affecting product quality. Assessment of DREF-II and DREF-III yarn structures and properties. Optimum process atmospheric conditions.

Module 5 Other Spinning Techniques

- Wrap spinning, Siro spinning, solo spinning, hollow spindle spinning, and self twist spinning.

Lab Outline:

As per Course Contents

Recommended Books:

1. Fundamentals of Spun Yarn Technology by C. A. Lawrence, 2003.
2. The Rieter Manual of Spinning by W. Klein, 2008
3. Advances in yarn spinning technology by C. A. Lawrence, 2010.

2. Advance Weaving

(2 1 3)

Objectives:

After completing this course, students should be able to:

- Understand different mechanism of various types of weaving machines
- Apply their theoretical and practical knowledge in fabric manufacturing process to overcome the mechanical and technical problems during operations of machines

Courses Contents:

Module 1 Shed Settings for Different Fabric Constructions

- Staggered shed: shed staggered in timing, staggered in degree, staggered in both timing and degree, asymmetric shed, shed setting for heavier fabrics, back shed settings, front shed settings, shed height and depth settings.

Module2 Dobby and Jacquard Shedding System

- Dobby Systems, Conventional Dobbies, Double Lift Dobbies, Cam Dobbies, Paper Dobbies, Knowel's Dobbies, Terry Dobbies, Rotary Dobbies, Electronic Dobbies
- Jacquard Systems, Conventional Jacquards, Jacquard System Basics, Single Lift Jacquard,
- Double Lifts Jacquard, Electronic Jacquard Basic, Jacquard Harness Types and its parts

Module 3 Detailed Weaving Mechanism of Rapier Weaving Machine

- Versatility of rapier weft insertion mechanism for all types of conventional and high performance yarns. Types of rapier weaving mechanisms. Rigid and flexible rapiers. Single and double rapiers. Use of rapier weaving for technical fabrics. Machine settings for carbon, kevlar, glass, dyneema and other higher performance yarns.

Module 4 Detailed Weaving Mechanism of Air-jet Weaving Machine

- Air-jet nozzles, insertion and auxiliary nozzles. Ultrasonic cleaning of nozzles. Machine operating pressure. Air consumption/pick. Pneumatic tuck-in system and its limitations. Rotary leno in air-jet weaving. Machine with onboard air compressor, servo motor let off and take up.

Module 5 Selvedge Formation for Shuttleless Weaving Machine

- Tuck-in selvedge: tuck-in selvedge in projectile and pneumatic tuck-in airjet weaving. Limitation of tuck-in selvedge against machine speed and warp threads density at the selvedge etc. Leno selvedge: half and full leno selvedge formation. Necessity of dummy selvedge for leno. Rotary leno selvedge. Leno waste. Tension setting for dummy and leno yarns.

Module 6 Sizing

- Advancements in sizing, refracto-meter for viscosity measurements, sequence of leasing rods. Brake operation of warp beams. Settings of different tension zones w.r.t., different yarns types. Effect of tension setting in one zone w.r.t., other zones. Sizing Vs doubling. Recycling of sizing agents. Film making for different sizing chemicals. Rubber roller grinding and rubberization. Calibration of different sizing machine parts. How to design sizing recipe for different fabric constructions.

Module 7 Automation in Weaving

- Automatic Drawing-In, Automatic Knotting, Quick Style Change, Automatic Warp Creel filling, Automatic Leasing

Lab Outline:

- Machine settings for fabrics on rapier weaving machine
- Machine settings for fabrics on airjet weaving machine
- Shed settings for sear-sucker and Bedford cords
- Shed setting for high cover factor fabrics
- Terry towel machine settings for pile height and pile density
- Warp beam set formation for different fabric constructions
- Viscosity measurements for sizing liquids
- Warp Tension settings in sizing machine

Recommended Books:

1. W. S., Weaving: Technology and Operation by Omerod, A. and Sodhelm
2. Weaving Mechanism Volume 1 10th Edition by J. E. Fox,

3. Textile Printing

(3 1 4)

Prerequisites:

Chemistry–II Introduction to Textile Chemical Processing and Chemical Pre-treatment of Textiles

Objectives:

In this course students will study principles and practice of different methods and styles of printing including block printing, flat screen printing, rotary screen printing, direct style, resist style, discharge style, burn-out printing, flock printing, transfer printing and ink-jet printing. The course covers print design studio, screen making, print past preparation & rheology, printing process and fixation. The students learn printing of fabrics of natural, manmade and blended fibers with pigments and other dyestuffs, role of auxiliaries and the working principles of machinery used for printing and fixation. The course also includes lab practice.

Course Contents:

Module 1 Introduction

- History of Textile Printing
- Essential definitions and terms used in printing and their explanation
- Theory of textile printing.
- Pretreatment requirements of the substrate to be printed like singeing, desizing, scouring, bleaching, mercerization etc. & their effect on the final printed goods.

Module 2 Textile Printing Methods

- Block printing
- Roller printing
- Hand screen printing
- Semi-automatic flat screen printing
- Fully automatic flat screen printing
- Rotary screen printing

Module 3 Print Design Studio & Engraving

- Introduction to print design studio
- CAD/CAM
- Rotary screen engraving

Module 4 Rotary Screen Printing Machines

- Mechanical aspects of rotary printing machines
- Design registration, blanket & screen synchronization & related concepts

Module 5 Production & Properties of Printing Pastes

- Stock printing paste preparation & dispensing
- Properties of ideal thickeners
- Types of thickeners
- Manual dispensing techniques
- IPS (Integrated paste preparation & dispensing systems)

- Print Paste Rheology

Module 6 Printing with Different Colorants

- Pigment printing
- Reactive printing of cotton
- Vat printing of cotton
- Disperse Printing of Polyester

Module 7 Textile Printing Styles

- Direct printing
- Resist printing
- Discharge printing
- Burn out printing
- Transfer printing

Module 8 Print Fixation & After-treatment Processes

- Print paste fixation mechanisms & equipments
- Curing
- Ageing, Flash Ageing
- Steaming
- Washing off process & washing off equipment.

Module 9 Digital Textile Printing

- Image capture & display
- Screen making using digital pattern data
- Digital control systems
- Ink-jet printing
- Variables affecting reproducibility

Module 10 Printing Faults & their Countermeasures

- A study of the faults that may occur during and/or after printing and their countermeasures

Lab Outline:

- Preparation of flat printing screen
- Stock paste preparation for pigment printing and its viscosity optimization
- Pigment printing of P/C fabric by flat screen printing
- Pigment printing of P/C fabrics by rotary screen printing
- Comparison of direct and over-printing of p/c fabric with pigments
- Stock paste preparation for reactive printing and its viscosity optimization
- Printing of cotton lawn with reactive dyes by steaming fixation
- Printing cotton fabric by roller printing method
- Comparison of direct and over-printing of cotton fabric with reactive dyes
- Printing p/c fabric with disperse/reactive dyes
- Printing p/c fabric with disperse/vat dyes
- Printing 100% polyester fabric
- Printing acrylic fabrics with cationic dyes

- Printing silk fabric with acid dyes
- Discharge printing
- Resist printing
- Burn-out printing
- Flock printing

Note: The students should become able to identify required chemicals and auxiliaries, design recipes and process conditions, monitor and control process conditions and evaluate the processed fabric.

Recommended Books:

1. Textile Printing by W. C. Miles, Society of Dyers and Colorists, 2003
2. Digital Printing of Textiles by H. Ujiie, 2006.
3. Novel processing in special finishing and printing of textile by F. Uddin and M. Lomas, 2010.

4. Industrial Engineering in Garment Manufacturing (3 1 4)

Objectives:

This course aims at introducing students to different industrial engineering concepts including productivity, work study and method study.

Course Contents:

- Concepts of production and productivity
- Role of industrial engineer in apparel production
- Method study and analysis
- Time and motion study
- Work study and measurement
- Job design
- Apparel production systems and factory layout
- Material handling in apparel production
- Application of IE techniques in garment industry
- Line balancing
- Scientific method of training (SMT)
- Industrial engineering in apparel quality control
- Apparel costing
- Measurement and control of wastages in apparel production

Lab Outlines:

- To conduct method and time study of Waist Band attachment operation for SAM calculation.(Micro motion)
- To conduct method and time study of Back Pocket attachment operation with help of a Pocket setting machine for SAM calculation.(Micro motion)
- To conduct method and time study of side seam operation for SAM calculation.
- To conduct method and time study of bottom hemming operation for SAM calculation.

- Developing flow chart and operation break down of Crew Neck Shirt.
- Developing flow chart and operation break down of Denim Trousers.
- To calculate consumption of thread in different seam and stitches of garment bottom.
- To calculate consumption of thread in different seam and stitches of garment top.
- Method and time study of operator's skill/dexterity assessment exercises.
- Use of different machine attachments for method improvement.
- Development of detailed apparel costing sheet.

Recommended Books:

1. Industrial Engineering in Apparel Production by V. R. Babu, Woodhead publishing 2011.
2. Introduction to Clothing Production Management, by A. J. Chutter. 2001.
3. Production Control Tools for Garment Industry, Sewing research institute Juki. 2004.
4. Sewn Product Analysis by Ruth. E. Glock 2007.
5. The Binran, Juki Corporation, 2006

COURSE CONTENTS – Textile Engineering (Depth) Textile Engineering Elective –V

1. Spinning Calculations
2. Weaving Calculations
3. Textile Finishing
4. Advances in Apparel Production

1. Spinning Calculations (3 1 4)

Objectives:

- The objective of this course is to enable students to perform various kinds of calculations related with blowroom, carding, drawing, combing, simplex, ring and other processes

Course Contents:

Module1 Blow-room calculations

- Calculations related to raw material requirement, Blow room production, draft at scotcher running efficiency, cleaning efficiency percentage, Waste percentage, Lap CV%, Lap weight per yard, and Lap rejection percentage.

Module 2 Calculations on Carding Machine

- Calculations related to Card production, cleaning efficiency, total draft, and tension draft.

Module 3 Calculations on Draw frame

- Calculations related to production calculations, total draft, break draft, main draft, and efficiency.

Module 4 Calculations on Lap Former and Comber

- Calculations related to Lap former production, draft, efficiency.
- Calculations related to comber production, noil percentage, draft

Module 5 Calculations on Simplex

- Calculations related to simplex production, draft calculations, twist, winding rate, delivery rate.

Module 6 Calculations on Ring Frame

- Calculations related to Ring production (OPS, pounds, bags), draft calculations, twist calculations.

Module 7 Calculations on Winding Machine

- Calculations related to production on winding machine

Module 8 Calculation on Rotor Machine

- Calculations related to rotor production, draft calculations, twist calculations.

Module 9 Spin Plans

- Designing of spin plans for different counts of yarns (Cotton carded Yarn, Cotton combed Yarn, Blended Yarn), Average count calculation.

Lab Outline:

- Study of gearing on bale opener
- Study of gearing on scutcher
- Study of gearing on card
- Study of gearing on draw frame
- Study of gearing on lap former
- Study of gearing on comber
- Study of draft and twist gearing mechanism of simplex for making the given roving
- Study of lifter and tension gearing mechanisms of simplex for making given roving
- Study of gearing on ring frame
- Study of gearing on doubling frame
- Study of driving mechanisms on mach coner
- Study of gearing on open end machine

Recommended Books:

1. Cotton Spinning Calculations by Scott-Taggart, Bolton
2. Textile Mathematics, Vol. I, II, III by J. E. Booth
3. Cotton Spinners Handbook by Gupta
4. Manual of Cotton Spinning by Textile Institute

2. Weaving and Knitting Calculations (3 0 3)

Prerequisites:

Introduction to Fabric Manufacturing, Weaving Preparatory Processes

Objectives:

This course will focus on the calculations involved in weaving and knitting processes, which include yarn and production calculations.

Course Outline:

Module 1 Factors involved in woven cloth contraction, cloth geometry

Module 2 Determination of diameter of yarn, cover factor, cloth setting rules

Module 3 Production and planning for weaving and knitting process

Module 4 Weight of warp and weft per running yard/meter

Module 5 Weight of warp and weft per square yard/meter

Module 6 Weight per yard when using different counts and different material

Module 7 Weight of fabric and wastage calculation

Module 8 Weight of cloth with reference to picks and ends

Module 9 Yarn requirement for a particular quality and quantity of cloth

Module 10 Yarn quantity for a particular width and length of cloth

Module 11 Production planning and machinery requirements for certain quality and quantity of cloth in specific period

Module 12 Economic evaluation of different machines

Module 13 Cost of production and profitability calculation

Module 14 Material cost calculation, labor cost and total cost calculation

Module 15 Calculation of moisture regain and moisture content.

Module 16 Atmospheric condition in weaving shed i.e. relative humidity and temperature

Recommended Books:

1. Weaving Technology and Operations by Allan Ormsrod
2. Shuttle less weaving machines by Idrich Talavasek
3. Weaving Calculation by Sen Gupta
4. Weaving Machine, Mechanism & Management by Talukdar

3. Textile Finishing

(3 1 4)

Prerequisites:

Textile Pre-Treatment, Textile Dyeing, Textile Printing

Objectives:

In this course, the students will study the classification, rationale, principles, mechanisms, and methods of different mechanical and chemical finishing processes. The students will cover finishes like chemical softening, hand-building finishes, drying and setting, easy-care finishes, water- and oil- repellent finishes, flame retardant finishes, soil release finishes, anti-static finishes, UV protection finishes, antimicrobial finishes, finishes for color fastness improvement, calendaring, emerizing, raising, compressive shrinkage, bio-polishing and other novel finishes. The course also includes lab practice.

Course Contents:

Module 1 Introduction to Textile Finishing

- Textile finishing and its classification
- Explanation of primary and secondary effect of finishing
- Flow chart of different routes adopted in the finishing of woven and knitwear fabrics

Module 2 Introduction to Mechanical Finishing

- Need and importance of mechanical finishing
- Different types of processes used in mechanical finishing with respect to end results and customer requirements
- Calendaring
- Sueding/Emerizing/Peaching
- Raising
- Sanforizing
- Compressive shrinkage

Module 3 Application of Chemical Finishes

- Calculation required for the application of chemical finishes
- Explanation of methods involved in the application of chemical finishes like dip and nip method, low wet pick up application method, saturation removal method, spray application method, foam application method and system, wet on wet application method.

Module 4 Chemical Softening

- Objective and need for chemical softening
- Classification of softeners w.r.t. their functionality
- Classification of softeners w.r.t. their nature
- Chemistry of different softeners and their mechanism of application on textiles
- Application methods involved in the processing of substrate with softeners
- Exhaust and continuous application of softeners
- Evaluation of softeners by subjective and objective methods.

Module 5 Hand Building Finishes

- Definitions and terms involved in hand building finishing
- Objective and need of hand building finishes
- Hand building effect and example of textiles with hand building finishes
- Chemistry of hand building finishes and their mechanism
- Evaluation of substrate and troubleshooting for hand building finishes

Module 6 Easy care and Durable Press Finishes

- Objective and need for easy care finishes
- Mechanism of easy care and durable press finishes
- Chemistry involved in durable press finishes
- Application method for resin finishing
- Compatibility of resin with other finishes
- Evaluation of substrate by different testing methods

Module 7 Oil and Water Repellent Finishes

- Objective and need for oil and water repellency
- Mechanism of repellency
- Chemistry of oil and water repellent finishes
- Application method for oil and water repellent finishes on textiles
- Evaluation of textiles treated with repellent finishes

Module 8 Soil Release Finishes

- Objective and need for soil release substrate
- Mechanism of soil release
- Chemistry of soil release finishes
- Application method for soil release finishes on substrate
- Evaluation method of soil release treated substrate
- Troubleshooting for soil release finishes

Module 9 Flame Retardant Finishes

- Objective and need for flame retardency
- Mechanism of flame retardency
- Chemistry of flame retardant finishes
- Application of flame retardant on different type of textiles like cotton, polyester, nylon etc.
- Evaluation of flame retardants
- Troubleshooting for flame retardant finishes

Module 10 Antistatic Finishes

- Objective and need for antistatic finishes
- Mechanism of antistatic finishes
- Chemistry of antistatic finishes
- Application methods and combinability
- Evaluation of antistatic finishes
- Troubleshooting for antistatic finishes

Module 11 Anti-pilling Finishes

- Objective and need for anti-pilling finishes
- Mechanism involved in the formation of pills

- Mechanism of anti-pilling finishes
- Chemistry of anti-pilling finishes
- Evaluation of anti-pilling finishes
- Troubleshooting for anti-pilling finishes and compatibility

Module 12 Non-slip Finishes

- Objective and need for non-slip finishes
- Mechanism of non-slip finishes
- Chemistry of non-slip finishes
- Application methods and combinability
- Evaluation of non-slip finishes
- Troubleshooting for non-slip finishes

Module 13 Finishes to improve Color Fastness

- Objective and need for improving color fastness
- Mechanism for improving wet fastness
- Mechanism for improving light fastness
- Mechanism for improving crocking and rubbing fastness
- Chemistry involved in different finishes applied to improve fastness

Module 14 Antimicrobial Finishes

- Objective and need for antimicrobial finishes
- Properties of an effective antimicrobial finishes
- Mechanism of antimicrobial finishes
- Chemistry of antimicrobial finishes
- Evaluation of antimicrobial finishes
- Troubleshooting for antimicrobial finishes

Module 15 UV Protection and Bio Finishes

- Objective and need for UV protection and bio finishes
- Mechanism of UV protection and bio finishes
- Different type of enzymes used for textile in finishing
- Chemistry of UV and bio finishes
- Evaluation of substrate applied with UV protection and bio finishes
- Troubleshooting for UV protection and bio finishes

Lab Outline:

- Application of cationic softener on knitted fabric by exhaust method
- Application of cationic, non-ionic, and silicone softeners by pad method, and compare the properties of the finished fabrics
- Application of hand building stiff finish using starch, PVA and acrylates, and compare the properties of the finished fabrics
- Application of DMDHEU-based wrinkle recovery and durable-press finish
- Application of melamine-based resin
- Application of formaldehyde-free crease recovery finish based of polycarboxylic acids
- Application of different water-repellent finishes
- Application of water and oil repellent finishes
- Application of antimicrobial finish

- Application on non-durable and semi-durable flame-retardant finish
- Application of durable flame-retardant finish
- Simultaneous pigment dyeing and crease-recovery finishing
- Application of soil-release finish
- Simultaneous application of multiple finishes
- Bio-polishing of cellulosic and p/c blended fabrics
- Comparison of different denim washes (e.g. with amylases, cellulases, pumice stones, hypochlorite, lacchases, potassium permanganate)

Note: The students should become able to identify required chemicals and auxiliaries, design recipes and process conditions, monitor and control process conditions and evaluate the processed fabric.

Recommended Books:

1. Textile Finishing by Derek Heywood, Society of Dyers and Colorists, 2003
2. Chemical Finishing of Textiles by W. D. Schindler and P. J. Hauser, Woodhead Publishing, 2004
3. Chemistry and Technology of Fabric Preparation & Finishing by Charles Tomasino, 1992

4. Advances in Apparel Production (2 1 3)

Objectives:

The objective of this course is to introduce students to recent advances in apparel production.

Course Contents:

Module 1 3 D body scanning to improve apparel fit

Module 2 Computer-aided garment design using 3 D models

Module 3 Computerized pattern making in garment production

Module 4 Advances in apparel product development and product lifecycle management (PLM)

Module 5 Advances in sewing and pressing garments

Module 6 Subjective and objective assessment of clothing appearance/aesthetics

Module 7 Subjective and objective assessment of clothing fit

Module 8 Subjective and objective assessment of clothing comfort

Module 9 Relationship of garment pattern design and comfort

Module 10 Methods for improving aesthetic, comfort and fit in apparel

Recommended Books:

1. Advances in apparel production by C. Fairhurst, Woodhead publishing 2008
2. Clothing appearance and fit: science and technology by J. Fan and W. Yu, Woodhead publishing 2004

3. Improving comfort in clothing by G. Song, Woodhead publishing, 2011.

COURSE CONTENTS – TEXTILE ENGINEERING (DEPTH)

Textile Engineering Elective –VI

1. **Specialty Yarns**
2. **Specialty Weaving**
3. **Textile Coating**
4. **Apparel Merchandising and Sourcing**

1. **Specialty Yarns** **(3 0 3)**

Prerequisites:

Yarn Production Engineering, Advanced Spinning Techniques

Objectives:

In this course students will study different types of fancy yarns, their production, properties and end uses.

Course Contents:

Module 1 Introduction

- Introduction and background, Historical development, market for fancy yarns, Manufacturing attitudes and the applications of fancy yarns for weaving and knitting.

Module 2 Fancy Yarn Structures

- Fancy yarn structures, and analysis of fancy yarns, Types of fancy yarns (Marl yarn, Spiral yarn, Gimp yarn, Diamond yarn, Eccentric yarn, Bouclé yarn, Loop yarn, Snarl yarn, Mock chenille yarn, Knop yarn, Slub yarn, Neppy yarn and fleck yarn, Tape yarn, Chainette yarn, Chenille yarn, Cover yarn, Metallic yarn)

Module 3 Manufacturing Techniques

- Ring spindle system, hollow spindle system, combined systems, doubling system, condenser system, open-end spinning system, friction spinning system, Air texturing. Chenille yarn production, flocking.

Module 4 Design and Applications

- The design of fancy yarns using computers, designing fabrics using fancy yarns and fancy doubled yarns, uses for fancy yarns, potential of fancy yarns (apparel fabrics, furnishing fabrics)

Recommended Books:

1. Fancy Yarns: Their Manufacture and Application by R. H. Gong and R. M. Wright, 2002
2. Hand Spinners' Workbook: Fancy Yarns by Mabel Ross, 1989

2. Specialty Weaving

(2 1 3)

Objectives:

- To develop in students an understanding about textile re-enforced preforms used in composites
- To enable students to apply theoretical and practical knowledge in fabric manufacturing techniques for producing varieties of fabrics.

Course Contents:

Module 1 3D performs:

- Textile performs used in composites, 3D woven performs, Multilayer fabrics the backbone of 3D weaving. History of multilayer fabrics. The 2D and 3D weaving concepts.
- Modifications in conventional weaving machines to weave 3D fabric. Modification in shed height, depth.
- Different possible axes in a 3D fabric.
- Fukuta's 3D-3axes weaving machine and fabric.
- M. H Mohammad's 3D-5-axes model and fabric.
- Circular and non-circular 3D fabrics,
- Concept of spacer fabrics, H, T and J beam sections.
- 2D and 3D braids

Module 2 Terry-towel weaving and weft pile fabrics weaving

- 3-pick and 5-pick terry fabrics, terry towel designs different machine settings for terry towels, calculation for contraction of pile warp threads, pile warp beam settings. Heald frame priority for low and high crimp wart threads.

Module 3 Sear-suckers:

- Explanations of machine settings for sear-sucker fabrics. Calculation for contraction of crimp warp threads, warp beam settings. Heald frame priority for low and high crimp warp threads.

Module 4 Circular weaving

- What is circular weaving, working of circular weaving and uses circular woven fabrics.

Lab Outline:

- Weaving of 3D multilayer fabrics on conventional 2D weaving machine.
- 4-layer 3D-honeycomb fabric weaving on conventional 2D weaving machine.
- Weaving of double plain cloth
- Multilayer weaving with extra threads stitching
- Multilayer weaving with raiser stitching
- Multilayer weaving with sinker stitching
- Weaving a terry towel on loom.
- 3D Kevlar fabric weaving on conventional 2D weaving machine

Recommended Books:

1. Textile Design Pure and Applied by E. B. Berry

2. Hand book of composites by S. T. Peters 1998
3. Fundamentals of composites manufacturing: materials, A. Brent Strong – 2008
4. Polymer matrix composites by Wang, Zheng 2011
5. Fetterly C. L. "Woven fabric" US Patent: 975940, (1910).
6. Fukuta K. "Three dimensional fabric, and method and loom construction for the production thereof" US Patent: 3834424, (1974)
7. Mohamed M. H. "Multi layer three dimensional fabric and method for producing" US Patent: 5465760, (1995).
8. Kadir B. A. "Multiaxial three-dimensional (3D) circular woven fabric" US Patent: 6129122, (2000).
9. Cheeseman B. A., Bogetti T. A. "Ballistic impact into fabric and compliant composite laminates" Composite structures, Volume 61, Issues 1-2, pp 161-173, (2003).

3. Textile Coating

(3 1 4)

Objectives:

- The objective of this course is to familiarize students with different coating materials, coating methods and machinery. The course also aims at developing an understanding about applications of coating and important characteristics of coated textiles.

Course Contents:

Module 1 Polymeric Materials for Coating

- Natural and synthetic rubbers
- Polyvinyl chloride coatings
- Polyurethane coatings
- Acrylic coatings

Module 2 Coating with Functional Materials

- Coating with phase change materials
- Coating with flame retardants
- Coating for chemical protection
- Coating with microcapsules containing fragrance, anti-microbials, etc.
- Coating with conductive materials
- Coating with smart polymers and nano materials

Module 3 Coating Rheology

- Rheological behavior of fluids
- Rheological behavior of plastisols

Module 4 Coating Methods

- Knife coating
- Roll coating
- Dip coating
- Transfer coating
- Coating with screens

- Foam coating

Module 5 Properties of Coated Fabrics

- Tensile strength and elongation
- Adhesion
- Tear strength
- Weathering behavior
- Yellowing
- Microbiological degradation

Module 6 Coating Applications

- Breathable water-proof fabrics
- Artificial leather
- Architectural textiles
- Automotive textiles

Lab Outline:

As per course contents

Recommended Books:

1. Coated Textiles – Principles and Applications, 2nd Edition by Asish Kumar Sen (CRC Press, 2008)
2. Coatings Technology Handbook, 2nd Edition by D. Satas, (MARCEL DEKKIENRC, 2001)

4. Apparel Merchandizing and Sourcing (3 1 4)

Course Contents:

Module 1 Introduction to marketing, merchandizing and sourcing

Module 2 Evolution of garment merchandizing

Module 3 Modern merchandizing

Module 4 World clothing markets

Module 5 Line development: principles, process and technologies

Module 6 Costing and pricing strategies

Module 7 Clothing supply chain management

Module 8 Sourcing strategies

Module 9 Clothing quality management

Recommended Books:

1. Apparel Merchandising: The Line Starts Here by Jeremy A. Rosenau and David L. Wilson, Fairchild Publications, 2010.

COURSE CONTENTS – INTER-DISCIPLINARY ENGINEERING (BREADTH ELECTIVE)

- 1. Mechanical Engineering Fundamentals**
- 2. Electrical & Electronic Engineering Fundamentals**
- 3. Engineering Drawing**
- 4. Instrumentation and Control**

1. Mechanical Engineering Fundamentals (2 1 3)

Objectives:

- To develop in students an understanding of different engineering materials and properties, fundamentals of machining, heat and mass transfer and maintenance of textile machines.

Course Contents:

Module 1 Introduction

- Basics of mechanical engineering, engineering materials.

Module 2 Mechanical Engineering

- Mechanical engineering codes and standards mechanical automation

Module 3 Fluid Dynamics

- Fluid engineering, Heat transfer theory

Module 4 Engineering materials:

- Ferrous and non-ferrous metals, their properties and uses. Alloy metals properties and uses, Heat treatment of steel

Module 6 Workshop practice

- Hand tools, types and uses. Mechanical workshop rules and practices.

Module 7 Welding, riveting and fittings

Lab Outline:

As per Course Contents

Recommended Books:

1. Fundamentals of Mechanical Engineering by IDC Technologies, 2010, available at www.idc-online.com
2. Heat Transfer by J Holman
3. Thermodynamics by R. S. Khurmi

2. Electrical and Electronic Engineering Fundamentals (3 1 4)

Objectives:

- To introduce students to fundamentals of electrical and electronic systems, their components and working principles.

Course Contents:

Module 1 Electrical Engineering Fundamentals

- Electric and Magnetic Circuits: Electric circuits, Kirchoff's Laws, Star-mesh transformations, DC circuits and their applications, series and parallel circuits, magnetic circuits, principles of calculation of Ampere-Turns for magnetic circuits of electromagnets, inductances in series and parallel, losses (AC), eddy current loss.
- AC Single and Poly Phase System: Single-phase systems, series & parallel circuits, measurement of power and power factor, Poly phase generation, star and delta connections, voltage and current relations, balance and unbalance load analysis.
- DC Machines: Construction, simple lap and wave winding, elementary concept of armature reaction and commutation, cross and demagnetizing ampere turns. DC generators, types, EMF equation, losses, efficiency, back EMF, torque, speed and speed regulation
- AC Synchronous Machines: Construction, EMF equation, speed and frequency, losses and efficiency, alternator on load, voltage regulation by synchronous impedance method, synchronous motors.
- AC Induction Machines: Induction motors, construction, types, working principle, losses, efficiency.
- Transformers: Construction, working principle, no load working and vector diagram, magnetizing circuit, equivalent circuit, open circuit and short circuit tests, losses, efficiency.
- Power generation, transmission, distribution and conservation.

Module 2 Electronic Engineering Fundamentals

- Semiconductor materials; p-type and n-type materials, Electronics in the field of Textiles Engineering. Semiconductor theory: Electrons within atoms, Electron arrangement in semiconductor atom, changes within atoms caused by doping to form N-type material, the PN depletion area, transistor parameters and equivalent circuits.
- Diodes: Ideal diode, terminal characteristics, types and applications.
- Transistors: Bipolar junction transistor, physical structure and modes of operation, characteristic curves, transistor as an amplifier and as a switch, field effect transistor (FET), types of FET.

Lab Outline:

As per Course Contents

Recommended Books:

1. Basic Engineering Circuits Analysis by J. David Irwin and R. Mark Nelms
2. Electronic Devices and Circuits by T. F. Bogart
3. Huges, E. Longman “Electrical Technology”, latest edition.
4. Stephen J. Chapman “Electrical Machinery Fundamental”, latest edition.
5. Chute, G. M and Chute, R. D., “Electronics in Industry”, McGraw-Hill Book Company, Singapore, latest edition.

3. Engineering Drawing

(0 1 1)

Objectives:

1. To understand the principles of mechanical drawing and design
2. To learn how to select the correct engineering materials
3. To apply specific needs of mechanical automation
4. To understand the fundamentals of machinery maintenance

Course Contents:

Module 1 Introduction

- Drawing equipment and the use of instruments, Basic drafting techniques and standards.

Module 2 Basic Engineering Drawing

- Projection of points, lines, planes and solids. Orthographic projections.

Module 3 Geometrical Curves

- Plane curves, cycloid, hypocycloid, and the Involute. Intersections at various positions of geometrical bodies such as prisms, pyramids, cylinders and cones.

Module 4 Concept of Working Drawing

- Size, description, dimensions, and specifications, limit dimensioning, and geometric tolerance, limits fits and tolerances, conventional symbols.

Module 5 Drawing of Textile Machine Components

- Nuts and bolts, shafts, couplings, bearings, pulleys, connecting rods, locking arrangements. Sectioning of machine components. Assembly drawing.

Module 6 Isometric Views

- Isometric views with especial reference to piping and ducting.

Lab Outline:

- Drawing elements and their used: “drawing board, T-square, Drawing instruments and scale”
- Lines, lettering and dimensions: types and applications in engineering drawing and graphics.
- Geometrical constructions: “ angles, circles, triangles, tangents, curves and engineering projections in practices”

- Assembly and production design: “concepts of elevation and end view of projection, industrial production drawing concept with specifications.
- Mechanical joints (welded joints; rivets; nuts and bolts; screw fasters); keys; keyways.
- Tolerance limits and fits
- CAD/CAM in Engineering Drawing (Solid works or Pro-E)

Recommended Books:

1. A First Year Engineering Drawing by A. C. Parkinson, 1998.
2. Elementary Engineering Drawing by N. D. Butt
3. A Manual of Engineering Drawing by T. E. French and C. J. Vierich, 2000 (McGraw-Hill).
4. Basic Technical Drawings by B. Bielefeld, 2002.
5. Practical Geometry and Graphics W. Abbot

4. Instrumentation and Control (2 1 3)

Objectives:

- To introduce students to the working principles of different types of measuring instruments and control systems used in textiles

Course Contents:

Module 1 Introduction

- Introduction to automation, types of automation, reasons for automation. Production operation and automation strategies.

Module 2 Measurement Devices and Gauges used in Textile Mills

- Fundamental principles of instrumentation system, instrument performance errors, measurement classification and methods, strain measurement, linear and angular displacement measurement, force, pressure, fluid flow, time, frequency and speed measurement, vibration measurement and temperature measurement, signal processing, displays and recording instruments.

Module 3 Sensors/Transducers used in Textile Machines

- General principles of sensors/transducers, active and passive transducers, resistive, capacitive, inductive, thermo-electric, piezoelectric, optical, elastic, pneumatic, differential pressure and rotating discs sensors/transducers,

Module 4 Signal Conditioning and Processing

- Wheat stone bridge, potentiometer, amplification, attenuation, filtering, modulation, voltage to current and current to pressure conversion.

Module 5 Data Display and Recording

- Moving coil meter, galvanometric, potentiometric, monitors, data loggers, printers and electronic storage devices.

Module 6 Control System

- General introduction, open-loop and close-loop systems, basic elements of a close loop system, close and open loop transfer

function, feedback, effect of disturbance, dynamic characteristics. Transfer function and transfer operator, derivation of control, analysis of multi loop-system.

Module 7 Actuating and Controlling System

- Introduction, single conversion, electric, pneumatic, hydraulic and thermal actuators control elements. Two step control, proportional, integral and differential controls. Linear feedback control systems, optimal control system, computer assisted optimal control.

Module 8 Computer Process Control of Textile Machines

- The computer process interface, interface hardware, computer process monitoring, types of computer process control, direct digital control, supervisory computer control, programming for computer process control. Technical study of the computer process control of various textile machines.

Lab Outline:

- To Measure the Voltage and Current by using Sanwa (ZX-505) MultiTester
- To demonstrate Transducer used in UTR
- To demonstrate the transducer used in weaving machine.
- To demonstrate the basic components of Automation used in Uster Tester.
- To demonstrate the pointer display devices such as stelometer
- To Measure the speed of Shaft or spindle by using Stroboscope
- To study the force measuring equipment.
- To Measure the Temperature by applying Thermo coupling
- To demonstrate the function of microprocessor used in Textile Machines.
- To demonstrate Auto leveler used in carding
- To demonstrate the Auto leveler used in draw frame
- To demonstrate the working principle and functions of robot used in Rotor (Automated).
- To demonstrate the automation used in Rotor R-40

Recommended Books:

1. Engineering Instrumentation by Collett, C. V. and Hop, A. D. latest edition.
2. Engineering Instrumentation and Control by Haslam, J. A. *et al*
3. Automation in the Textile Industry by Grady, P. L. *et al*.

COURSE CONTENTS –SENIOR DESIGN PROJECT

- 1. Senior Design Project – I**
- 2. Senior Design Project – II**

1. Senior Project Design – I (0 3 3)

Objectives:

Application of Textile Engineering Principles in designing new textile products/processes, improving existing products/processes or providing innovative solutions to textile industry problems.

Note: At the end of Semester 7, the project synopses must have been finalized including a thorough literature review and detailed research design.

2. Senior Project Design – II (0 3 3)

Objectives:

Application of Textile Engineering Principles in designing new textile products/processes, improving existing products/processes or providing innovative solutions to textile industry problems.

Note: At the end of Semester 8, the project theses must have been completed.